A DISPENSATORY,

OF

COMMENTARY ON THE PHARMACOPŒIAS OF GREAT BRITAIN;

COMPRISING

THE NATURAL HISTORY, DESCRIPTION, CHEMISTRY, PHARMACY, ACTIONS, USES, AND DOSES OF THE ARTICLES OF THE MATERIA MEDICA.

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SECOND EDITION, REVISED AND IMPROVED,
WITH A SUPPLEMENT, CONTAINING THE MOST IMPORTANT NEW REMEDIES.

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PREFACE TO THE SECOND EDITION.

THE Author has to express his great regret that the appearance of this work has been postponed long after it was called for by the favourable reception of the first edition. The delay has arisen partly from the pressure of other occupations inseparable from his profession and public duties, partly from the belief, that the rumour of an approaching new edition of the London Pharmacopœia would, if realised, have enabled him to suppress many otherwise unavoidable commentaries.

The present edition contains a short Supplement of New Remedies which have come apparently into general use since the publication of the last Edinburgh Pharmacopœia in 1841. The number of these, though small, is probably greater than necessary: for several will scarcely stand the test of time and experience. The body of the work, although not increased in size, has been greatly altered by numerous additions and alterations. For some of the corrections, the author is indebted to Mr Richard Phillips; who, with a pertinacity of criticism unexampled in these days, has during several years exercised his censorship on the book from time to time in three distinct periodicals, and in an express publication. A Dispensatory being no fit field for controversy, the Author has been content with silently adopting or rejecting the proposed corrections according as they were felt to be just or un-

just, reserving till the present opportunity the expression, once for all, of his sense of the uncommon pains and trouble which have been taken by Mr Phillips.

Under the dread that another winter might pass by without the appearance of the work, the Author has taken advantage of the co-operation of Dr Douglas Maclagan, Lecturer on Materia Medica, to whom he is under deep obligations for adjusting his notes, and supplying numerous valuable additions, under many of the articles.

Edinburgh College,
April 10, 1848.



INTRODUCTION

SOME GENERAL PROCESSES IN PHARMACY.

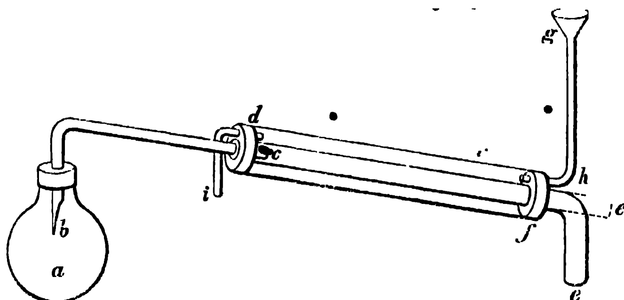
For reasons which have been stated in the Preface, a systematic treatise on Pharmacy, and on pharmaceutic operations and apparatus, will not be attempted here. But nevertheless some introductory observations will be required on the general heads under which the processes of the pharmacopœias have been classified. These observations will be most conveniently made, conformably with the general plan adopted throughout the present work, in the form of a commentary on the instructions given by the Colleges.

ACIDS.

Under this head no general directions have been given by the Colleges, and few remarks are called for here.

Most of the acids are obtained by the process of distillation. For this purpose many employ, even in small operations, the common retort and receiver, or a succession of receivers in the form of Wolfe's apparatus; and heat is generally applied through the medium of the sandbath. In the case of acids, however, whose vapours do not promptly corrode cork, there is considerable advantage, in point of facility of operating, certainty of result, and security against breakage, in substituting for the ordinary apparatus a wide-mouthed glass mattrass, connected by a curved tube with what is called Liebig's refrigeratory. As this apparatus is of great service in many other processes of distillation in pharmacy, it deserves description here. The curved tube *bc*, cut obliquely at *b* to prevent any spurted-up liquid from passing along it, is connected by a cork to the mattrass *a*, and in a similar way to the refrigeratory. The refrigeratory consists of an outer tube of glass, brass, copper, or tinned-iron *df*,—an inner tube of glass or block-tin, *ee*, which is connected with the outer tube by a perforated cork at each end, and terminates either in a straight extremity, or in a curved portion for fixing it into a bottle when the distilled liquid is very

volatile,—a funnel *g h*, perforating the cork at the lower end, for admitting a stream of cold water into the interval between the two

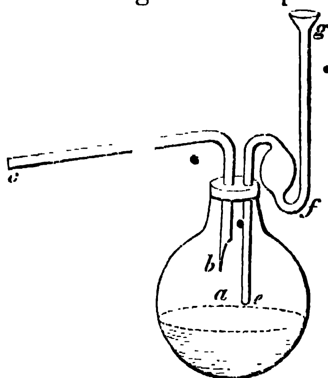


tubes,—and a discharge-tube *d i*, perforating the upper cork, for the escape of the heated water. If water be supplied by the funnel *g* from a cistern by means of a block-tin syphon, with a stop-cock for regulating the flow, and the water as it escapes at *i* be led into a bucket, or the sink of a cistern, the process of distillation may be allowed to go on for a long time without being watched. A refrigeratory, whose outer tube is twelve inches long, and about an inch and a quarter in diameter, will be powerful enough to condense the whole vapour from a mattrass capable of containing two pints of rectified-spirit in a state of brisk ebullition. With such an apparatus, medicinal hydrocyanic acid or sulphuric ether may be distilled quickly without loss even in summer, although water of ordinary temperature be used for keeping the refrigeratory cool. —Mattrasses for this and other purposes are generally made too thin. They stand heat equally well when considerably thicker, provided they be blown uniform in that respect; and they are then much less apt to be broken by succussion of the boiling fluid, or in subsequently cleaning them.

In distilling acids and other volatilizable liquids, heat is commonly applied through the medium of a sand-bath. But in operations on a moderate scale, there is great convenience in substituting the direct heat of gas-burners, where coal-gas is made of fine quality, as in this city. The most serviceable flame for the purpose is that of a horizontal rose-burner; that is, a burner with a flat circular head about an inch in diameter, perforated round its side with fourteen holes, not exceeding a sixtieth of an inch in diameter. A circle is thus formed of horizontal jets, which, bending slightly upwards towards their points, adapt themselves to the form of a mattrass or retort. Owing to the facility with which such a flame is regulated, alcohol, ether, and other inflammable fluids may be distilled in this way with a naked heat in complete safety; and the uniformity of the heat allows of the operator absenting himself for hours if he chooses. Coal-gas was first used as fuel in chemical operations by my predecessor Dr Duncan.

ALCOHOL AND ETHERS.

In all distillations of alcoholic or etherial fluids, the apparatus described in the last page, is greatly superior to the ordinary retort and receiver. The rapidity with which the operation may be carried on without loss is much greater than by any other method. Under the head of sulphuric ether, a description and figure will be found of the apparatus for preparing this fluid by means of a continuous supply of rectified-spirit. In the present place, it may be well to notice the arrangement of the apparatus for preparing nitric ether according to the process in the Edinburgh Pharmacopœia. It consists of a mattrass *a*, such as that represented in page ii.——an exit-tube *b c*, for the etherial vapour, which is condensed in a refrigeratory,——and a safety-tube, *e f g*, which is filled with nitric acid before the operation begins, and which must be so placed as to leave the point *e* about an inch above the fluid in the mattrass. With such an arrangement, and a little sand in the bottom of the mattrass, nitric acid may be poured upon rectified-spirit with perfect safety at intervals, and a strong hyponitrous ether obtained without any risk of explosion. (See *Aether nitrosus.*)



ALKALIS.

No general observations seem necessary under this head.

ALKALOIDS.

The Vegetable Alkaloids may be obtained by a variety of processes; which invariably however comprehend decomposition of the alkaloidal salt in the crude drug, either by the superior affinity of an alkali, earth, or alkaline carbonate, or by double decomposition with some compound salt, whose base forms an insoluble salt with the acid in the drug. Active neutral principles, such as narcotin from opium, piperin from white pepper, picrotoxin from cocculus-indicus, and elaterin from elaterium, may be obtained through the agency of such simple solvents as water, rectified-spirit, and sulphuric ether, used singly or successively. But no alkaloid can be thus detached.

The solutions, from which vegetable alkaloids are prepared, are in general obtained best by the method of percolation, or displacement. Some experience is required to apply this process in all cases with success. But, when well performed, it is greatly superior in general to every other mode of extracting the active matters of vegetable drugs, when the liquid used is spirituous or ethe-

rial; and it is often not less advantageous in the instance of water, as well as acidulous fluids. The precautions for applying it successfully will be considered under the head of Tinctures.

CONSERVES. ELECTUARIES. CONFECTIONS.

There is no essential difference in the nature of the preparations indicated by these various names. They are intended sometimes for use as vehicles to impart a convenient form to other drugs, and especially as adhesive menstrua to give them the form of pill;—but they also constitute in themselves a form for administering various remedies. For the last purpose they are preferred chiefly when the dose of an insoluble medicine is bulky, or when its disagreeable taste is best covered by sweet substances. In preparing them, the solids to be converted into an electuary or confection ought generally to be in the first instance finely pulverized and then mixed together; otherwise, when pulpy or viscid matters are subsequently added, they cannot be reduced to a fine state of division, or mixed with uniformity. The simplification of prescriptions in modern times is gradually diminishing the number of preparations of this kind. No other form was so convenient as that of electuary for administering the extraordinary farrago of drugs which it was once the fashion to prescribe.

DECOCTIONS.

This is a common form for administering drugs from the vegetable kingdom. But it is often far from an eligible one. It has been long adhered to, and with too little discrimination,—probably because pharmacologists, misled by finding the refuse after decoction in general inert, concluded that the active materials were entirely taken up by the water. This however is by no means always the case. For since the late discovery of the active principles of the vegetable world, it is well known that the activity of vegetable drugs is often materially diminished or entirely destroyed by boiling them in water, if their active constituents be volatile. As instances in point may be mentioned the *Decoctum guaiaci compositum*, so far as its sassafras is concerned,—the *Decoctum sarzæ compositum*, on account of the same ingredient,—the *Decoctum hæmatoxyli*, in reference to the cinnamon added to it,—the *Decoctum scoparii compositum*, in reference to the juniper-tops; and the *Decoctum sarzæ* of the three Pharmacopœias is considered by good authorities to be similarly circumstanced. In other cases during ebullition important chemical reactions take place, in consequence of which the active constituents are either rendered insoluble, or undergo decomposition. Cinchona-bark for example cannot be boiled in water sufficiently for the extraction of its active principles, cinchonia and quina, without these alkaloids combining with the red colouring principle of the bark, and forming a compound sparingly soluble at 212°, and almost insoluble at 60°.

In making Decoction of aloes protracted ebullition is unadvisable, because the soluble active principle, aloësin, undergoes oxidation, and passes to the state of insoluble, inert resinoid matter. In the case of Senega-root, a decoction cannot be made without the active principle, Senegin, forming an insoluble compound with the colouring matter and albumen of the root; so that this preparation ought to be abandoned, as the Edinburgh College has done, in favour of an infusion. In other instances again the effect of a boiling temperature is to enable the water to dissolve out principles injurious to the quality of the preparation. Of this result an excellent illustration is Calumba-root, which contains, besides an active bitter principle easily soluble in cold water, a large quantity of starch, which cannot be dissolved except at a temperature near that of ebullition, and which ought to be left behind if possible, because it renders the solution mucilaginous and apt to become speedily mouldy.

The process of boiling is the less necessary, that in general the same proportion of water exhausts vegetable substances equally well at 60° in the way of percolation, as at 212° in the way of decoction, and often more completely. There are important exceptions however. For nux-vomica is with difficulty exhausted by cold water in any mode, while it is more readily exhausted by the method of decoction. And all the emulsive preparations, which depend for their properties upon starch or certain forms of the gummy principle, require ebullition; for otherwise the emulsive principles are not dissolved at all.

Decoctions should be prepared in vessels so far covered as to preclude a free circulation of air, without preventing the escape of steam. The process should be continued for as short a period as suffices for duly extracting the active materials of the drug. And subsequent concentration by prolonged boiling should for the most part be avoided. The vessels used for preparing decoctions are best made of glass or earthen-ware; but on the large scale clean cast-iron pots, or vessels of copper, brass, or tinned-iron are often admissible. Copper vessels are frequently to be avoided because vegetable decoctions corrode them, and may become dangerously impregnated with the metal, especially if allowed to cool in them. Iron vessels cannot be used when the vegetable contains astringent matter. Zinc vessels, once a good deal used, are now almost abandoned; for zinc is more quickly corroded by many vegetable infusions than any of the metals in common use.

DISTILLED-WATERS.

GENERAL DIRECTIONS, *Edin.* Distilled waters may be prepared from fresh, and generally also from dried, vegetables. In the latter case only half the weight of material should be used. They may also be prepared for the most part by agitating the volatile oils of plants with water and filtering the solution. But

distilled waters obtained in this way have seldom so fine a flavour as those obtained from plants themselves.

Dub. To every pound of water distilled from any vegetable matter add half an ounce of rectified spirit.

Distilled-waters consist of the volatile oils of odoriferous vegetables dissolved in water. They are generally obtained by distilling water from crude vegetable substances; but they may be often conveniently made, by agitating water with the volatile oil obtained previously and kept in store for the purpose, or by distilling the water and oil together. Fine distilled waters may be made by simple agitation of volatile oils with water; provided the oils be recent and skilfully prepared. But if the oils have been long kept, they become in part oxidated by absorption of oxygen from the air; and it is found that distilled-waters of rich fragrancy cannot be prepared from volatile oils of this kind. Hence for the most part the crude vegetable substances themselves are preferred, when they can be had. Many of these substances lose their volatile oil and fragrance when dried, and must consequently be used in the fresh state. But in some instances,—most of which are specified by the Pharmacopœias,—the oil is retained notwithstanding desiccation, so that the dried plant is available for the purpose of the distiller. Many vegetables, which lose their fragrance when dried, retain it in perfection for years when preserved by being beat into a pulp with salt, and may be used in this state for making excellent distilled-waters. Even rose-water may be thus made of fine quality.

Heat may often be applied directly to the vessel; but in this way empyreuma is apt to be occasioned, especially in large operations, in consequence of the solid matters remaining fixed at the bottom. To avoid this, it is usual to apply the heat in limited operations through the medium of a solution of hydrochlorate of lime, which raises a temperature between 212° and 270° according to its strength,—or by means of an oil-bath with a thermometer to regulate the temperature; and on the great scale it is applied best of all by means of steam admitted under pressure into a space surrounding the still.—Another cause of the empyreumatic taint of some distilled waters is the formation of a species of mucaginous substance at the expense of the volatile oil (Brendecke). This substance, which forms chiefly when the distillation is pushed too fast or too far, and is seen encrusting globules of volatile oil undissolved in the water, is apt to deposite itself on the side of the still above the boiling materials; where it is afterwards decomposed by the heat. This fact explains the well-known observation, that the finest distilled waters are obtained by gentle distillation, and by abstaining from complete exhaustion of the materials. A still greater improvement is to prepare them with the vacuum-still in the same way as is now often practised in making extracts. Liebig's refrigeratory (p. ii.) is here again the best contrivance for condensing the vapour.

The material which supplies the volatile oil is in general simply mixed with the water in a state of fine division; and this is probably the best mode where heat is used in such way as to exclude the risk of empyreuma. If it does not require to be finely divided, as in the case of fresh leaves and flowers, it may be put conveniently into a net-bag; which is suspended in the middle of the still, and may be withdrawn with facility when its contents are exhausted. Some manufacturers use, not water, but steam for obtaining distilled-waters: That is, the material to be distilled is spread over a fine gauze partition or a plate perforated with numerous small holes, and steam is driven through the mass.

When the vegetable substance to be exhausted is a bark, wood, or other solid matter, it must be reduced to a state of moderately fine division. But this is not generally necessary in the case of leaves or flowers, because boiling water breaks down the cells in which the volatile oil is contained. When leaves however are thick and leathery, as in the instance of the cherry-laurel, the process is facilitated by chopping them down; and in most cases, where leaves are large, it is difficult to get a sufficient quantity into the still without cutting them into pieces.——In preparing the finer kinds of distilled waters, it is necessary to clean the materials carefully, to remove all decayed leaves or flowers, or those infested by insects, and sometimes also to separate the leaf-stalks, or the green claw of the petals.

Distilled waters, however carefully they may be kept, are apt to lose their aroma sooner or later; and some of them even become mouldy and acquire thereby an unpleasant odour. They have been thought to keep better with the addition of about a fortieth part of rectified spirit; which may be either put into the still with the water, or added afterwards to the distilled fluid. But the advantages of this addition, although sanctioned by the authority of the Dublin Pharmacopœia, are doubted by practical men. And it is believed that the most effectual precaution for preserving them is to prepare them with extremely pure natural waters, such as snow, rain, or very fine spring water [Müller], free especially of any unusual proportion of carbonic acid; and to keep them in black, orange, or red bottles, not in bottles of clear glass [Hänle].

ENEMAS.

A consideration often neglected by practitioners in extempore prescriptions for administering drugs in the form of injection is, that the volume of it must vary with the object. If it be intended to evacuate the gut, the quantity of the fluid should not be less than sixteen fluidounces or a pint. But if the medicine be intended to exert its own peculiar action through absorption, or through the nervous system, it ought to be administered in a quantity of fluid

not exceeding four fluidounces; otherwise it may be speedily ejected. owing to the mere mechanical stimulus of distension.

EXTRACTS.

General Directions, *Edin.* Extracts are usually prepared by evaporating the expressed juices of plants, or their infusions or decoctions, in water, proof-spirit, or rectified-spirit, at a temperature not exceeding 212° by means of a vapour-bath. Most of them however may be obtained of greatly superior quality by the process of evaporation in vacuo. And the extracts of expressed juices cannot perhaps be better prepared than by spontaneous evaporation in shallow vessels, exposed to a current of air. Extracts should be evaporated to such a consistence as to form a firm pill-mass when cold.

Lond. In preparing extracts, unless otherwise directed, let the liquor be evaporated in a basin as quickly as possible over a vapour bath, stirring it assiduously towards the close, till a consistence be attained fit for making pills.

To all the softer extracts a little rectified spirit ought to be added, for the prevention of mouldiness.

Dub. All the simpler extracts, unless ordered otherwise, are to be prepared in the following manner. Let the vegetable materials be boiled with eight times their weight of water, till half the liquid remain; then express the liquor and strain it when the impurities have subsided; next evaporate it with a higher heat till it begins to thicken; finally with a moderate heat, applied by a vapour-bath, let it be concentrated, with constant stirring, to a consistence proper for making pills. In this way are prepared extract of Artemisia Absinthium; Aloes hepatica; flowers of Chamomile; tops of Spartium scoparium; root of Glycyrrhiza glabra; root of Gentiana lutea; saw-dust of Haematoxylon campechianum; cones of Humulus Lupulus; bark of Quercus Robur; leaves of Ruta graveolens; herb and root of Leontodon Taraxacum.

The preparation of Extracts has been always a subject of much attention in pharmacy; because it has been supposed, that in this form medicines may be not only preserved better and longer than in any other shape, but likewise administered more conveniently and in a more concentrated state. It has been ascertained however, in consequence of the discoveries made during the present century regarding the proximate constitution of vegetable and animal substances, that the concentration and permanence of their virtues in the form of extract is not so general a fact as was previously imagined. These results, together with the substitution of active principles instead of galenical preparations, has led in recent times to the distrust, or abandonment, of many extracts once in general use. At the same time much information has in the same way been acquired as to the conditions to be observed for preparing extracts correctly; so that the distrust entertained of this particular form rather depends on the negligence or ignorance with which it is usually prepared, than attaches absolutely to the form itself.

Extracts are made either from expressed juices of plants, or from watery and spirituous solutions of their active constituents. A preference has been generally given to inspissated juices,—sometimes with justice, but frequently for no better reason, than that the natural constitution of active vegetable drugs is supposed to be less altered in this form than in any other. The reason is a questionable one. In some instances expressed juices do not con-

tain the whole active constituents of plants,—as in the case of monkshood, where most of the acrid principle is left behind. And in others, such as hemlock, the making of an extract by inspissation of the juice is attended with the risks which are apt often to arise from the concurrent influence of water and heat. These risks, which have been already discussed under the head of Decoctions, consist in the dissipation of volatile matters,—the conversion of fixed soluble principles into insoluble and therefore more inactive compounds,—and the transformation of active constituents into principles totally different, and wholly inert. All these objections to the form of watery decoction apply with tenfold force to the form of extract, as usually prepared. Some extracts indeed may be correctly obtained in this way, such as extract of gentian, calumba, liquorice-root, rhatany-root, pareira, log-wood, dandelion, quassia, colocynth, and nux-vomica,—more especially if the heat be applied through the medium of boiling water or steam at 212°. But others are thus greatly deteriorated or altogether spoiled, such as the extracts of most narcotic vegetables; and this result is certain if the heat be either continued too long, or raised above 212°. The extract of hemlock, for example, when kept for even a few minutes too long over the vapour-bath after the inspissation of the juice is nearly completed, exhales ammonia of a peculiar heavy odour, and becomes soon inert from the conversion of its alkaloid into an inactive resin.

Various means have in consequence been proposed for securing the due preparation of such extracts. In the first place something may be done by taking care that the heat be not allowed to exceed 212°, nor the liquor at any time to boil,—that the material be diligently stirred towards the close,—and that the concentration be stopped the moment the odour exhaled becomes ammoniacal, or undergoes any other change.

These measures however are not always sufficient; and more extensive alterations of procedure have been recently adopted, with unquestionable advantage. Of these the simplest, and perhaps one of the best, is the substitution of spontaneous evaporation at ordinary atmospheric temperatures. Some years ago I made some experiments on this method, chiefly in consequence of the representations of Mr Cheyne, at the time an intelligent druggist of this city. About the same period similar inquiries were made in London and elsewhere. The general result is, that many, probably indeed all, expressed juices, which do not owe their virtues to a volatile oil or other principle expelled or destroyed by drying, may be converted with little loss of activity into the form of firm extract. by evaporating them without artificial heat in shallow vessels exposed to a current of air, and protected from dust and insects by gauze screens. Even hemlock-juice, the properties of which are more easily injured by pharmaceutic processes than those of any other medicinal substance I am well acquainted with, may be form

ed in this manner into a powerful and easily preserved extract. Watery infusions or decoctions have not appeared to me so easy to manage in the same way; as they are more apt to become mouldy before being sufficiently concentrated. But they might be brought under the same treatment by directing over their surface, in any of the ordinary modes, a strong current of air heated to about 100°, so as to accelerate evaporation. I have also found that extracts prepared by spontaneous evaporation keep very well for at least three years. They never acquire the honey-like odour common to most extracts prepared in the ordinary method. Such extracts are now to be met with in the establishments of various druggists in Edinburgh, and deserve to come into general use.

Another method, which was first practised, at least on a scale for consumption, by Mr Barry of London, consists in evaporating the fluid, whether expressed juice or decoction, in a vacuum. The vacuum is produced either by transmitting steam through the apparatus before closing its openings, or more usually now by an air-pump. The advantage is, that the fluid may be boiled, not merely out of contact with atmospheric air, so that its principles cannot undergo oxidation, but likewise at a temperature so low, generally about 140°, that the other intimate changes observed to occur at a more elevated temperature, take place imperfectly or not at all. Hence the extracts are obtained of a paler colour and finer odour than in the ordinary method; their aroma is purer and stronger; they are more soluble; and undoubtedly their energy is greater. Extracts thus prepared, besides being of fine quality in the first instance, also keep remarkably well. I have specimens in my possession presented to my predecessor Dr Duncan by Mr Barry between 1820 and 1824, which are still in excellent preservation. The only one indeed which seems to have lost energy is the extract of hemlock; from which no alkaloid is now disengaged by solution of potash. The preparation of extracts in vacuo is gaining ground slowly among druggists; and is practised in this city as well as in London. The chief objections to it are the expense, which however is not considerable, the slowness with which the concentration goes on towards the close, and the difficulty of removing firm extracts from the apparatus.

I am inclined to think, that the method at once the most perfect and most convenient, especially where watery infusions and decoctions must be prepared in the first instance, is by combining the two modes already mentioned. That is, the fluid should be evaporated in a vacuum to the consistence of syrup, which may be accomplished quickly, and then in shallow vessels exposed to a current of air without heat, until the extract be dry and hard or nearly so. In this way the fluid is not apt to become mouldy, as in the case of spontaneous evaporation alone. Excellent extracts have been lately made in this manner in Edinburgh; and they seem to keep well.

When extracts cannot be obtained by inspissation of the natural juices of vegetables, boiling water is the menstruum that has long been generally preferred for obtaining in the first instance a solution of their active ingredients. But a variety of circumstances, which are specified in the observations on the making of Decoctions and Infusions, render it preferable to employ cold water, especially in the way of percolation, in the numerous instances where the active ingredients of plants are soluble in water at atmospheric temperatures. Infusions of this kind, evaporated first in a vacuum to a syrup, and then spontaneously in a current of air, will commonly yield extracts of fine quality both as to energy and permanence. Occasionally the infusion may be obtained at once of syrupy consistence, and evaporation in a vacuum consequently dispensed with, by passing the same fluid successively through several portions of the material to be exhausted; and the residuum in the percolators is afterwards thoroughly exhausted by passing, in succession, through them in the first instance, the fluids of the next two or more operations. In some cases, water in every shape is an ineligible menstruum. For sometimes its solvent action over the active constituents of drugs is feeble; sometimes it dissolves along with their active parts, gum, sugar, and other principles, which add to the bulk of the extracts, or render them more prone to decay; and lastly, it is sometimes injurious by its own reactions upon the proximate principles of plants. The substitution of proof-spirit will often obviate entirely the first of these inconveniences, and in part the second also; but it cannot prevent the reactions of water, because, in evaporating the menstruum, the spirit passes off first, and the water is left in a great measure till the close. Hence in some instances it is necessary to use rectified-spirit for the solvent. There is no doubt that where rectified-spirit dissolves out the active constituents of vegetables,—and there are few cases in which it does not,—this is the best menstruum for obtaining extracts. For it often dissolves readily active principles which water acts on feebly; it frequently leaves behind certain common principles, which water dissolves, and which are either simply inert or likewise affect the permanence of the product; and in the subsequent distillation of the spirit, the active principles in solution are exposed neither to the decomposing influence of water, nor to that of a high temperature. Hence, for example, rectified-spirit is the best menstruum for preparing the extract of narcotic vegetables in their dry state; and of all fresh narcotic vegetables whose virtues are not entirely removed with their expressed juices. Extracts of this kind are highly energetic; and they may be preserved without alteration for several years, as I have ascertained to be the case in the instances of foxglove, monkshood, and hemlock. The expense of preparing them in this country, and the unnecessary dread entertained of their activity, have hitherto prevented alcoholic extracts from coming into

general use. But they are probably for the most part the best of all the varieties of the present pharmaceutic form.

When spirit is employed as a solvent for the preparation of extracts, it is applied in one of two ways,—sometimes by percolation without heat, sometimes by decoction. The former method, which is generally sufficient for the purpose of exhausting the drug, and requires for the most part scarcely more spirit than the method by decoction, will be found fully explained under the head of Tinctures. The latter besides being more troublesome, is attended with more loss of spirit, especially if care be not taken to save what is driven off in vapour. For this end the best contrivance is Liebig's refrigeratory reversed. The mattrass, containing the materials to be boiled, is to be attached with a tight cork to the extremity *e* (see Fig. at page ii), which in this case ought to be cut obliquely, as at *b*, to allow the condensed spirit to drop as it trickles down the tube; and a receiver should be attached, but not closely, at *b*, to receive any spirit which may nevertheless pass over.

Weak acids are sometimes used for exhausting vegetable drugs of their active constituents, prior to concentrating them in the form of extract. The acid for this purpose must be volatile, and incapable of disorganizing vegetable substances when it becomes moderately concentrated. Hence acetic acid which unites these two properties in the greatest degree, is usually employed for the purpose, and in the form of distilled vinegar or diluted pyroligneous acid. There is only one officinal extract prepared in this way, the extract of colchicum of the London and Edinburgh Pharmacopœias; but the number might probably be increased with advantage.

Some extracts may be preserved almost indefinitely without undergoing any change. Occasionally little care is required for the purpose, except that the place where they are kept shall be moderately dry; and at other times the same object is effectually and conveniently accomplished by covering the vessels which contain them with bladder. There are other extracts however, which, although well made and skilfully preserved, lose their activity by degrees, owing to obscure chemical reactions between their constituents, different from those actions which constitute the more familiar kinds of vegetable decay. In particular, the extracts of narcotic plants seem to be thus circumstanced. Their deterioration may often be retarded by the improvements mentioned above in the preparation of them, more especially by obtaining them in the form of spirituous extract; and it is also of some service to moisten the common extracts with a little rectified-spirit, as directed in the London formula. Notwithstanding every possible precaution a diminution of activity takes place sooner or later in various instances. Accordingly all extracts ought to be examined attentively from time to time, and renewed when necessary. And such extracts as those of monkshood, belladonna, hemlock, digitalis, henbane, and thorn-apple, if made in the common way, should be distrusted if

more than a twelvemonth old. The taste, colour, and odour are generally resorted to as criterions of their quality; but these are all in some measure fallacious. Nor do we possess any other good general method of examining them. Righini says well-prepared extracts of the juices of plants may be known by the peculiar odour of the plant being evolved on adding a twentieth part of diluted sulphuric acid to a watery solution. In the case of narcotic extracts the best criterion, but one too inconvenient for practical use, is the effect of a given quantity introduced in a state of watery solution into the subcutaneous cellular tissue of a small animal such as a rabbit.

HONEYS.

The Colleges have not given any general directions for the preparation of Honeys; nor are any required here. It is an officinal form which was once in great repute; but the number of preparations of this kind has been gradually diminished, because they possess no advantage over syrups and confections. Care must be taken to employ only the fine qualities of honey in pharmacy, otherwise the officinal compound undergoes putrefaction and acquires a disagreeable taste and odour, owing to the decay of azotiferous ingredients contained in the coarser honeys.

INFUSIONS.

Few forms are more convenient for administering medicines from the vegetable world than that of infusion. The greater number of vegetable drugs are easily exhausted of their active parts in this way; the process is exceedingly simple and speedy, more especially as it is seldom necessary that the solid materials be in a state of fine division; and the form in which the active constituents are presented is one of the best for administration. The chief objection to infusions is, that they cannot be long kept, either in store by the druggist, or by the patient for consumption. They may be preserved however for months by pouring them while boiling hot into bottles up to the top, and forcing in strong corks of good quality [Alsop].

Infusions have hitherto been made in this country almost entirely with boiling water, which is poured on the materials in a lightly covered vessel, and either allowed to cool before filtration, or kept for some hours at a low heat beside a fire or otherwise. But of late the use of cold water in the way of percolation, or displacement, has been generally substituted in the higher departments of pharmaceutic chemistry; and it may probably be employed with equal advantage in the processes of ordinary pharmacy. Boiling water has the frequent disadvantage of dissolving, along with the active ingredients of vegetables, starch and other principles whose presence renders the infusions more apt to become acid or mouldy;

and it favours certain reactions between the proximate principles of plants, which have been adverted to in the remarks upon Decoctions, and through means of which active principles are either converted into insoluble compounds, or changed altogether in constitution. Percolation with cold water has the advantage of avoiding these inconveniences. Besides it is observed that cold infusions generally have less tendency to decay than those made at a boiling temperature, above all when they are prepared in a highly concentrated form. Hence they have the additional advantage, that,—as vegetable infusions may often be prepared of very great strength in this way,—by preserving only that part which first passes through, the druggist may keep a store for current use, requiring dilution merely to answer the demand arising from the extempore prescriptions of practitioners. In this way the exhausting of vegetable drugs by percolation with cold water might be turned to excellent account in the practice of the retail-druggist and hospital-apothecary. Without such advantage indeed the process would in various instances be less convenient than the ordinary mode of making infusions; because the materials to be exhausted generally require to be in a fine state of division, and occasionally more time is necessary.——The description of the process of Percolation will be found among the remarks on the preparation of Tinctures; for most of which it has been introduced by the last Edinburgh Pharmacopœia, where spirit is used as the solvent.

The method of percolation without heat has been hitherto adopted by the same College for only one preparation made with water as the solvent; namely, the infusion of Calumba, where it has the advantage of not dissolving starch. But there seems no reason why the same mode should not be applied to the preparation of the infusions of chamomile, cascarilla, catechu, chiretta, cusparia, gentian, krameria, pareira, quassia, red-rose, rhubarb, serpentaria, simaruba, sarsaparilla, and valerian; and possibly even other officinal infusions might be added to this list. It is probable that such preparations will keep better, if heated to 212° in well-corked bottles, by immersing them in boiling water; after which any albumen which may be separated should be removed by filtration.

METALS AND THEIR COMPOUNDS.

On the extensive and most important list of officinal preparations comprised under these designations it is unnecessary to make any general remarks. The catalogue of preparations belonging to each metal has been gradually reduced in number in the more recent editions of the Pharmacopœias. But every one must regret that trivial or doubtful reasons of convenience, and imaginary differences in kind or degree of action, have compelled the Colleges still to maintain the list unnecessarily copious and complex.

MIXTURES AND EMULSIONS.

These are preparations, extempore in their nature, and which the Colleges might perhaps have multiplied with advantage. Few forms are in more general use for the administration of remedies; and it would therefore be no small boon to the profession were the Colleges to collect approved prescriptions of the kind from practitioners of experience.

OINTMENTS, LINIMENTS, CERATES.

GENERAL DIRECTIONS, *Dub.* Calamine for making an ointment, must be prepared in the same way as chalk.

In compounding ointments, wax, resins, and fatty matters are to be melted with a gentle heat. When then removed from the fire, they are to be diligently stirred till they cool and concrete. And meanwhile, any dry substances to be added to them should be sprinkled in a state of very fine powder into the melted mass.

These preparations are for external use. They vary in consistence, Cerates being the firmest of all, Ointments softer, and Liniments softer still, or sometimes even liquid.

Many preparations of the present class are made by simply mixing or triturating their component parts together. But when resins, wax, spermaceti, or concrete oils are to be mixed either together or with fluid oils, it is better to mix them with the aid of heat, which not only liquefies the solids, but likewise renders them much more soluble in the liquids. Brisk agitation is required while the mixture concretes in cooling; otherwise the solid ingredients will separate either mechanically or by crystallization. Even in purifying lard or suet by fusion and filtration, it is right to stir the mass as it cools, otherwise the stearin or solid oil is apt to separate in part from the elain or liquid oil, so that an irregular mixture of the two principles is obtained. A gentle heat is sufficient for making ointments, cerates, and the like, because most of the ingredients are easily fusible; and a strong heat must be avoided, for in that case acrid acids are engendered, which may alter the properties of the preparation. Hence the vapour-bath is generally used for applying heat; and it ought always to be used in operations on a large scale.

PILLS.

Pills are the most convenient of all officinal forms, both for preservation, and for administration. They therefore abound in all the Pharmacopœias of this empire.

The making of a good pill-mass is a more difficult problem than it may seem at first sight. The mass must be of such consistence as to cohere strongly, and firm enough to retain the globular form; it should be so composed as not to be liable to grow mouldy; it ought not to contract moisture; and yet it ought not to be apt to harden quickly by undergoing desiccation. The materials for securing these objects, or Excipients, as they are technically called,

must vary in some measure with the active ingredients of the pill. Those in common use are bread-crumb, hard-soap, extract of liquorice, mucilage, syrup, treacle, conserve of red roses and conserve of hips. For extempore use, the most common solid excipients are bread crumb and liquorice-extract; and the liquids generally employed are syrup and mucilage. These substances answer well enough when the pills are not to be kept above a few days. But pills so composed soon become very hard; in which state their activity is materially impaired. In this respect treacle and conserve of red-roses or hips, but especially the two conserves, are greatly superior. From an extensive set of experiments made some years ago by Mr Cheyne, formerly a druggist in this city, and which were kindly communicated to me, it appears that, in the quality of preserving pills sufficiently soft, no other excipient equals conserve of red roses, and that treacle comes next to it; but that a little fixed oil may sometimes be usefully employed for the same purpose: and that advantage is at times derived from the addition of a small quantity of some deliquescent neutral salt, such as acetate of potash. I have repeated most of Mr Cheyne's experiments, and have found them quite exact. Several kinds of pills made with conserve of red-roses have been in my possession two years without becoming hard. The reason of this curious fact seems to be, that conserve of red-roses retains a certain quantity of moisture with so great avidity, that, as in a trial I made for six months together, it does not lose any weight under exposure to a moderately dry air, if it be at first of ordinary consistence. When pills contain a large proportion of resinous matter, one of the most simple and effectual methods for keeping them long soft, is to use a little rectified-spirit for softening them sufficiently in the first instance; because alcohol is retained with great obstinacy by most resins. For example, rectified-spirit is the best menstruum for reducing the compound-colocynth pill-mass to its due degree of softness; for it is strongly retained in small quantity by the resin of scammony, and probably also by the aloësin of the aloes.

The observations now made have been applied extensively to practice in the last Edinburgh Pharmacopœia, and with a great improvement in the energy and uniformity of action of many pill-masses. Some, however, maintain, that in preparing pills it is rather an object to make them hard; and at any rate, that there is no advantage as respects their activity in preserving them soft. This is a great mistake. If a comparative trial be made between such pill-masses, for example, as the compound-colocynth pill of the old Edinburgh Pharmacopœia made with mucilage, and the same pill of the new Pharmacopœia made with rectified-spirit, the advantage of softness will be at once apparent. The former gradually loses its energy as it grows hard, which happens in a week or ten days: The latter continues soft and of uniform activity for many weeks, unless in very dry air.

Pills are covered with a variety of substances, to prevent them from adhering together, or to obscure their taste. At one time it was the custom to cover them with gold-leaf or silver-leaf; and some physicians have lately proposed to revive this absurd practice. Liquorice-powder, wheat-flour, and wheat-starch are now most generally employed. But perhaps the most useful article for the purpose, by reason of its extreme tenuity and want of taste, is the substance called Lycopodium, the pulverulent seed of the club-moss or *Lycopodium clavatum*. This substance has gone out of use in Britain, but is still much employed on the continent. A few years ago it was ingeniously proposed in France to cover pills with gelatin by dipping them into a solution of bone-gelatin or isinglass. The method is troublesome, but otherwise answers well with most pills.

Inveterate custom and economy have sanctioned the practice of keeping pills in boxes of wood or pasteboard. They retain their activity better, because they are preserved soft much longer, if they be kept by the patient in small bottles.

There is reason to suspect that the officinal pills are in general too large. Five-grain pills often pass through the body apparently but little altered; and it has occurred to me to observe that four colocynth and henbane pills of one grain each will operate as effectually as two five-grain pills, and more mildly.

PLASTERS.

General Directions, *Dub.* The same rules are to be observed for preparing plasters as for ointments.

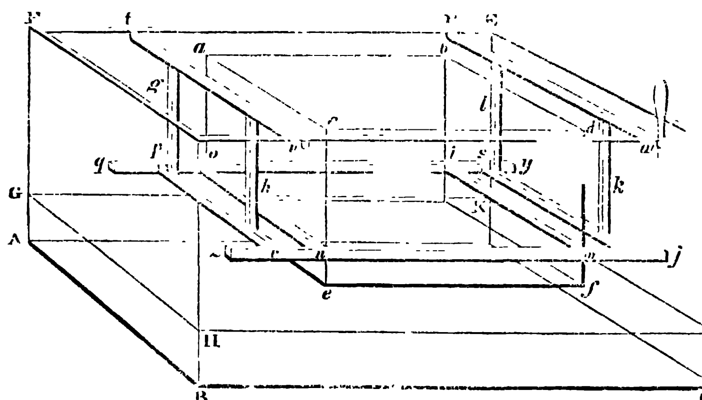
Under the head of Ointments, p. xv. a few observations on the mode of manipulating will be found, which apply for the most part also to the preparation of the plasters of the Pharmacopœias.

POWDERS.

General Directions, *Dub.* Let the substance to be reduced to powder be first dried and then bruised in an iron mortar; after which the powder is to be passed through a sieve, and kept in well closed vessels.

Officinal powders are now prepared on the great scale by the wholesale druggist, instead of being laboriously made as formerly by retailers. Some retail druggists however still prepare their own powders, for the sake of better securing their genuineness and purity. The Dublin College has given some general instructions for reducing drugs to powder. But the instructions are incomplete; for the most prompt and effectual mode of obtaining fine powder is to use the mortar and sieve alternately, —that is, to sift away the finer particles as soon as partial pulverization is accomplished, to pound or triturate again what remains on the sieve, to sift this as soon as a little more fine powder is formed, and to repeat the alternate trituration and sifting frequently till the whole substance has passed through the sieve. In

this way much time is saved, and much less of the finest powder is lost, by being driven off in pounding or triturating the coarser residue. To the practitioner who dispenses his own medicines it is both troublesome and wasteful to prepare powders on the limited scale which the wants of his practice require. He therefore generally obtains his drugs in the state of powder from the retailer or wholesale druggist. This is particularly the custom in respect to the very articles which are most subject to adulteration in the state of powder, and which are known to be genuine most easily, or only, when examined in the entire state,—namely drugs from the vegetable kingdom. Fine powders however may be easily prepared on the small scale with a proper sieve, such as the following. A box A B C D E F, ten inches long, six wide, and five deep, has a moveable lid at top (not here represented), and a drawer G H I K at the bottom. Within it is suspended a light wooden box *a b c d e f*, five inches long, four wide, and three deep, and having a bottom of fine, close muslin. This box slips into the frame *i m n o*, the prolongations of which *o q*, *n z* and *i y*, *m j* have circular holes for the axles *p r*, *s u* to turn in. These axles support, by the uprights *g*, *h* and *l*, *k*, two other axles *t v*, *x w*, which turn in grooves in the side of the outer box. When the winch *w* is turned with the thumb and fore-finger alternately from one side to another, the



inner box is moved backwards and forwards by means of the hinges *t v*, *x w* and *p r*, *s u*; and strong concussions are thus given to the inner box by the ends *q*, *z* and *i*, *y* of the frame alternately striking the inside of the outer box. Hence, if the partially prepared powder be put into the inner box-sieve, and the lid be put on, a very fine powder may be obtained in the drawer in a short time, without any loss from dispersion.

SPIRITS.

When spirit is distilled with aromatic vegetables which contain volatile oil, the oil for the most part rises with the spirituous va-

pour, and condenses along with it in a state of solution. Preparations of this kind are called Distilled-Spirits. In some cases the volatile oil rises with the vapour of strong spirit, so that rectified-spirit may be employed for the purpose; and this is occasionally necessary for keeping the oil of the distilled spirit in solution. In other instances the oil does not begin to pass over until watery vapour also passes in considerable proportion with the spirituous vapour; so that proof-spirit is required for the process.

For all medicinal purposes, but especially the present, proof-spirit should be made by diluting rectified-spirit with water. Even with this precaution, it is commonly held, that distilled spirits made in this country are inferior in purity of aroma to those prepared abroad; and the reason assigned is the greater purity of brandy-spirit, compared with that obtained from the grains. If the inferiority however of British distilled-spirits be so undeniable and so great as is alleged,—of which I have some doubt,—and the cause be what is represented, the inferiority ought not now to exist; because the impurities of grain-spirit may be entirely removed at moderate cost by the action of nitrate of silver on its grain-oil, as mentioned under the article Alcohol.

The best apparatus for preparing distilled-spirits is that represented at page ii. It has been proposed by some to prepare them by distillation in a vacuum-still; but many volatile oils will not rise with spirit-vapour at the low temperature at which spirit boils in a vacuum.

These preparations, like distilled-waters, may be obtained either from crude vegetable substances or from their volatile oils. They are seldom however of such fine aroma when prepared in the latter as in the former way, unless care be taken to employ only those volatile oils which have been recently as well as carefully distilled.

SYRUPS.

GENERAL DIRECTIONS, *Lond.* Syrups ought to be preserved in a place where the temperature never exceeds 55° F.

Dub. Syrups are to be prepared according to the following formula, when neither a particular weight nor mode of solution is enjoined.

Take of pure sugar in fine powder, twenty-nine ounces;

Of the prescribed liquor, one pound by measure (one old wine-pint).

Add the sugar gradually and digest with a gentle heat in a close vessel till it be dissolved, agitating frequently. Put the solution aside for twenty-four hours; skim off the scum, and pour off the syrup from the sediment if there be any formed.

The form of SYRUP is intended sometimes to cover the disagreeable taste of drugs, but more generally to preserve them in a convenient state for making mixtures, without the risk of their undergoing decomposition. They are prepared sometimes by simply dissolving sugar in a watery solution of the active ingredients, sometimes by concentrating the syrup after the sugar has been dissolved. The former method is necessary wherever the preparation

owes its activity to the presence of a volatile oil. Pure sugar is the saccharine substance most generally employed; but sometimes treacle answers better, as being less apt to crystallize, and more fitted for covering unpleasant tastes. In all cases it is necessary that the saccharine solution be of a certain strength; for if too strong, sugar is apt to crystallize in the syrup under the influence of cold and rest; and if too weak, the syrup is apt to become mouldy or undergo fermentation. In reference to these opposite inconveniences, it is found that the most suitable proportion is about two parts by weight of sugar to one of liquid. Even syrups of this strength however are apt to undergo important changes in summer when the atmospheric temperature rises; and hence various contrivances have been suggested for securing their durability. No contrivance yet proposed is at once convenient and efficacious, except the precaution enjoined by the London College, that syrups should be kept where the temperature does not exceed 55° F.; and this is not every where practicable. The addition to the syrup of a thirtieth part of sugar of milk prevents fermentation even at summer temperatures (Chereau), but does not prevent the formation of mould.

The strength of syrups is best judged of by their density, which should be 1385 at 60°. In concentrating syrups by evaporation, the operator sometimes judges when they have attained the due strength by finding that a pellicle tends to form on a drop as it cools. But a surer method is to observe the density; which, at the temperature of ebullition, is 1300 for syrup of the density 1385 at 60° (Duncan).

TESTS.

Ammoniae Oxalas, E.

Process, *Edin.* Take of
Oxalic acid, four ounces;
Carbonate of ammonia, eight ounces;
Distilled water, four pints.
Dissolve the carbonate in the water, add gradually the acid, boil and concentrate sufficiently for crystals to form on cooling.

Barytae Nitras, E.

Process, *Edin.* This salt is to be prepared like the muriate of baryta, substituting Pure nitric for muriatic acid.

Solutio Argenti Nitratis, E.

Process, *Edin.* Take of
Nitrate of silver, forty grains;
Distilled water, 1600 grains.
Dissolve the salt in the water, and keep the solution in well-closed bottles.

Solutio Argenti Ammoniati, E.

Process, *Edin.* Take of
Nitrate of silver, forty-four grains;
Distilled water, one fluidounce;
Aqua ammoniæ, a sufficiency.
Dissolve the salt in the water, and add the Aqua ammoniæ gradually, and towards the end cautiously, till the precipitate at first thrown down is nearly, but not entirely, redissolved.

Solutio Barytae Nitratis, E.

Process, *Edin.* Take of
Nitrate of baryta, forty grains;
Distilled water, 800 grains.
Dissolve the salt in the water, and keep the solution in well-closed bottles.

SOLUTIO SODAE PHOSPHATIS, E.

PROCESS, *Edin.* Take of
Phosphate of soda, free of efflorescence, 175 grains;
Distilled water, eight fluidounces.
Dissolve the salt in the water, and keep the solution in well-closed bottles.

In introducing a system of tests for ascertaining the requisite purity of drugs, and discovering their adulterations, the Edinburgh College has found it necessary to give a few processes for the preparation of the requisite reagents.

The process for OXALATE OF AMMONIA is a case of simple decomposition. Carbonate of ammonia and oxalic acid being brought together in their equivalent proportions, carbonic acid is given off; and by evaporation and cooling, oxalate of ammonia is obtained in beautiful acicular crystals. It is used as a test for lime.——The AMMONIATED SOLUTION OF SILVER is a medico-legal test, of much service for detecting arsenic. It consists of a solution of nitrate of silver, the oxide of which, after being thrown down by ammonia, is redissolved by an excess of the precipitant. In order to secure the due preparation of this test, there must not be an undue excess of ammonia; and therefore a little oxide is left undissolved. A diluted solution of nitrate of silver cannot be used so well for this test, because the oxide in that case is not thrown down at all by ammonia.——The other tests are solutions, in fixed proportions, of NITRATE OF SILVER, NITRATE OF BARYTA, and PHOSPHATE OF SODA, which are employed for ascertaining that various drugs are of the due degree of purity. A fixed volume of the test being added to a fixed quantity of the drug in solution, a precipitate is occasioned by double decomposition; and the proportions are so arranged, that, if the drug be pure enough, a small portion will remain in solution, and be indicated in the filtered fluid on more of the test being added. Examples of this very convenient mode of testing the purity of drugs will be found under the heads of *Acetum, Acidum hydrocyanicum, Magnesiæ sulphas, Potassæ carbonas.*

TINCTURES.

GENERAL DIRECTIONS, *Edin.* Tinctures are usually made by reducing the solid ingredients to small fragments, coarse powder, or fine powder, macerating them for seven days or upwards in proof-spirit or rectified-spirit, straining the solution through linen or calico, and finally expressing the residuum strongly, to obtain what fluid is still retained in the mass. A much superior method however has been lately introduced, which answers well for most tinctures, namely the method of displacement by percolation. According to this process, the solid materials, usually in coarse or moderately fine powder, are moistened sufficiently with the solvent to form a thick pulp; in twelve hours, or frequently without any delay, the mass is put into a cylinder of glass, porcelain, or tinned-iron, open at both ends, but obstructed at the lower end by a piece of calico or linen, tied tightly over it as a filter; and the pulp being packed by pressure, varying as to degree with various articles, the remainder of the solvent is poured into the upper part of the cylinder, and allowed gradually to percolate. In order to obtain the portion of the fluid which is kept in the residuum, an additional quantity of the solvent is poured into the cylinder until the tincture which has passed through equals in amount the spirit originally prescribed; and the spirit employed for this purpose is then recovered for the most part by pouring over the

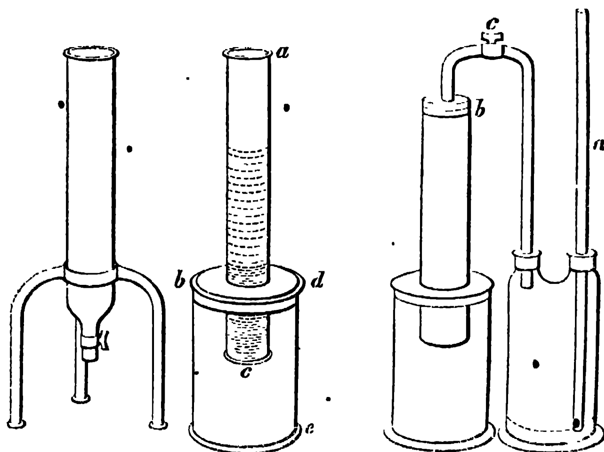
residuum as much water as there is of spirit retained in it, which may be easily known by an obvious calculation in each case. The method by percolation, where applicable, will be found much more convenient and expeditious than the mode hitherto commonly followed; and it exhausts the solid matters in general much more completely. As considerable practice however is required for managing the details in different cases, more especially in regard to the degree of minuteness of division of the solids, and the degree of firmness with which they are to be packed in the cylinder, we have thought it right to direct that the method by maceration may be followed as an alternative. But the method by percolation is now preferred by all who have made sufficient trial of it to apply it correctly.

Lond. All tinctures should be prepared in close glass vessels, and must be often agitated during the maceration.

Tinctures are solutions of vegetable and animal drugs, and sometimes of mineral substances, in spirituous fluids. The spirit employed is commonly proof-spirit, sometimes rectified-spirit, more seldom ammoniated spirit, and in a single instance spirit of sulphuric ether. The choice between the first two depends on their respective solvent power over the active constituents of the drugs employed. The last two are preferred sometimes on account of their peculiar properties as solvents, but more generally for the antispasmodic action possessed by ether or ammonia. The form of tincture is one of the best in pharmacy. For the menstruum is a powerful solvent of the active constituents of drugs; it presents them in small volume; it preserves them very long unaltered; and it is for the most part a convenient medium for uniting them with other substances in extempore prescriptions.

Tinctures have hitherto been generally prepared by macerating the solid materials in the spirit for a week (Edin. Dub.) or a fortnight (Lond.), without artificial heat; after which the liquid is poured off, the residuum subjected to strong pressure, and the whole fluid filtered. Sometimes, as in the case of tincture of opium, it is supposed preferable, where proof-spirit is the menstruum, to macerate the solid material in the due proportion of water, and then in a sufficiency of rectified-spirit; so that the two solutions, when mingled, shall constitute a tincture of proof-strength. But in recent times a different method has been adopted for obtaining spirituous solutions in chemical operations; and it has likewise been introduced with great advantage into pharmacy. This is the method by Displacement, or Percolation; which consists substantially in nothing else than the gradual transmission of the spirit through the solid materials in a state of moderately fine division. The Edinburgh College,—the first to recommend the adoption of the method by percolation for preparing most of the tinctures,—has given general directions for applying it, and more specific instructions under some particular preparations of the present class. The apparatus consists simply of a cylinder, Fig. 1. *a c*, open at both ends, covered at *c* with calico or linen as a filter, and fitted into the jar *d e* by means of a cork or wooden lid. The cylinder may be made of glass, earthen-ware, tinned-iron, or any other substance not easily acted on by spirituous solutions; and

they are now conveniently manufactured of glazed earthen-ware with a broad rim *b d* attached, which saves the trouble of fitting



them to the vessel beneath. It is sometimes advantageous to contract the lower end, so as to admit of a stop-cock on it, Fig. 2; by means of which the flow of the spirit may be stopped for a time, to allow of maceration being carried on. The substance to be exhausted must be reduced to various degrees of division in different instances; but for the most part the form of coarse powder is the most suitable, because when the powder is very fine, the fluid is apt to be arrested in its passage, after becoming saturated with the soluble principles. In general it is right to soak the powder for a few hours with a sufficiency of the spirit to make it into a stiff pulp before putting it into the cylinder, otherwise the spirit may make narrow passages for itself, and leave a part of the material unacted on; but in other instances no such preliminary step is necessary, and, as in the case of tincture of myrrh, the best procedure is to introduce the powder in the dry state into the cylinder, and to pour the spirit over it. The pulp or powder must be packed in the cylinder before the spirit is poured over it. The degree of pressure to be used, which varies in different instances, is to be learned only from experience in each; and it may be observed, that this is the operation, on the correct performance of which the success of the process chiefly depends, and the only one which requires some skill and nicety of management. If the material be loosely packed, the spirit passes through too quickly and not saturated; if too firm pressure be employed, percolation will take place too slowly, or not at all. On the whole, the firmness of the packing should be inversely as the solvent power of the spirit upon the solid materials; but this rule is far from being without excep-

tion. Since the fluid, for an obvious reason, passes after a time with increasing speed, it is occasionally necessary to press down the matter in the cylinder as the process advances; but this rule too does not always apply. In some operations, especially on the large scale, it is found useful to promote the percolation by pressure. This may be produced simply by supplying the solvent through a tube several feet high, adapted to the upper end of the cylinder, and terminating at the top in a funnel. A more perfect method, as involving the use of less spirit, is by means of compressed air, as in the apparatus, Fig. 3. By means of a condensing syringe, or a column of water or mercury in the tube *a*, air is condensed in the bottle below; and when the material and spirit have been introduced into the percolator, the top is secured tight by the screw *b*, and the compressed air is admitted by the stopcock *c*. This method answers excellently on the small scale with a column of mercury.

The solution which first passes through in this process is always in a state of high concentration. In general it is a simple solution of the soluble ingredients of the crude drug in the fluid employed as a solvent. But sometimes the solvent, if compound, is resolved into its component parts: and the fluid which passes through is only one of these, holding the soluble parts of the drug in solution. Thus, if proof-spirit be poured over powder of myrrh in the cylinder, the fluid which first drops into the receiver is a solution of oily consistence, composed of resin and volatile oil dissolved in alcohol. And if powder of galls be acted on in like manner by aqueous sulphuric ether, two layers of fluid are obtained, a highly concentrated solution of tannin in the water of the ether, and a weak solution of the same principle in pure ether.

Percolation is accomplished in the manner here described with little or no intermixture of the liquid above with that which is below in the pulpy mass. If, after the pulp has been allowed to drain till drops cease to fall, the quantity of spirit retained by it be ascertained—by subtracting what has dropped from what was used to make the pulp,—and the same quantity be poured gently over the mass repeatedly at intervals as soon as the dropping caused by each successive addition ceases, a series of liquids will be obtained by the simple displacement of one another in the pulp; and the last portion of spirit used may be obtained by pouring over the pulp the same quantity of water. Hence one of the many advantages possessed by this method of making tinctures, over the ordinary mode by maceration and expression, is that no part of the tincture is lost by being left behind in the residuum.

It was observed above, that the active constituents of drugs are capable of being preserved very long without alteration in the form of tincture. In almost all tinctures however a certain degree of change occurs, in some slowly, in others with considerable rapidity, —the consequence of which is that precipitates are formed. The nature of these changes, and of the deposites that take place, has

hitherto been little studied. But it is believed, that in general the deposit does not contain any material proportion of the active principles, and therefore that the energy of the tincture is not diminished.

TROCHES.

Troches, or Lozenges, are admitted only into the Pharmacopœia of the Edinburgh College. As they are justly in great demand, it seems right that the strength of those which contain active drugs should be duly regulated; nor is it a sufficient objection to this view, that the druggist commonly employs the confectioner to make his lozenges for him. Their basis consists of sugar, gum, and sometimes liquorice-extract. Care must be taken to avoid too much heat in making them, otherwise they may be rendered unpleasantly empyreumatic, or their active ingredients may undergo decomposition.

VEGETABLES, PREPARATION OF.

General Directions, *Lond.* Vegetables are to be gathered in dry weather, when not wet with showers, or dew. They ought to be collected annually, and thrown away when kept longer than a year.

Roots are dug up for the most part before the appearance of the stems or leaves.

Barks should be collected at the season when they are most easily detached from the wood.

Leaves should be gathered after the flowers are expanded, and before the seeds ripen.

Flowers should be plucked when fresh blown.

Seeds are to be collected when ripe, and preserved in their own pericarps.

All vegetables but those which are used fresh should be strewed loosely, and dried as quickly as possible with a gentle heat soon after being gathered; and they are to be kept in proper vessels, excluded from light and moisture.

Roots directed to be kept fresh should be preserved in dry sand. The cormus of *colchicum* and bulb of *squill* should be dried in thin transverse slices, after removal of their outer coats.

Pulpy fruits, if unripe, or ripe and dry, should be left in a damp place to soften; the pulp is then to be squeezed through a sieve; and it is next to be boiled over a low fire and frequently stirred, and finally evaporated in a water-bath to the proper consistence.

Cassia-pulp is prepared by bruising the pods, washing out the pulp with boiling water; passing the liquid first through a coarse sieve, and then through a fine one; and finally evaporating the fluid over a water-bath to the due consistence.

The pulp or juice of ripe fresh fruits is to be expressed through a sieve without any ebullition.

Opium is to be carefully cleared of foreign matters, especially on its outside. It is to be preserved soft for making pills, and hard, by evaporation in the water-bath, for conversion into powder.

The finest gum-resins are such as do not require purification. Those which are less pure should be softened in boiling water, expressed through linen, and left at rest till the resinous part subside. The supernatant liquor being poured off, it is to be evaporated in a water-bath; and the resinous portion is to be added towards the close, so that it may be reunited with the gum.

But when gum-resins melt easily, they may be put into a bladder and immersed in boiling water till they soften, and then freed of their impurities by squeezing them through linen.

Dub. The leaves or flowers of plants in a state of inflorescence are to be gently heated for an hour in paper bags; and being then strewed loosely on a sieve, they are to be dried as soon as possible, but without the heat being raised so high as to injure the colour. If herbs require to be used in the form of powder, they should be pulverised forthwith, and preserved in close, opaque bottles.

Herbs or flowers, from which distilled waters or oils are prepared, should be dried as soon as they are gathered.

The rules for the collection and preparation of vegetable simples cannot be treated of here systematically, without an extent of detail inconsistent with the objects of this Introduction. The reader is therefore referred for special directions in particular cases to the observations which follow on the several articles of the Materia Medica; and a few general remarks must suffice in the present place.

Many vegetable drugs are obtained from the wholesale druggist. But those used by the retailer or practitioner in the recent state are commonly collected for the purpose by the herbalist, and obtained directly from him. Many articles of this kind are extensively cultivated for medical use in various parts of Britain.

The collection of vegetable simples is an occupation that requires more skill and knowledge than are usually possessed by those who follow it. Their commodities, therefore, ought always to be tested by superior knowledge on the part of the druggist or apothecary. But this branch of the art of pharmacy also labours under the additional disadvantage, that its general principles are at present ill ascertained. The principles now current have been succinctly stated by the London College in its directions printed at the head of this article. But the doctrines there espoused are subject to numerous exceptions; and other modifying circumstances connected with vegetation might be mentioned, such as season, climate, weather, site, soil, exposure, cultivation, which have not been adverted to at all,—probably because the College felt that their respective influences have not been determined with such accuracy, as to admit of being expressed in general rules. I must take the liberty of re-stating in the present edition of these pages, my surprise that this entire subject,—interesting alike in a practical point of view, and in relation to the physiology of plants,—has hitherto received so little attention from scientific men. A few years ago I commenced an experimental inquiry on some departments of it, which other occupations compelled me to suspend. But I had gone quite far enough to be convinced, that the doctrines commonly held, as to the influence of various circumstances in vegetation on the activity of medicinal plants, are often erroneous, and generally subject to important exceptions; that the practical rules founded on those doctrines are sometimes faulty; and that the pharmaceutic art stands much in need of a new and thorough investigation of this imperfectly trodden field. Most works on pharmacy contain under the present head a Druggist's Kalendar, showing the several periods at which vegetable simples ought to be collected. But for the reason just adverted to, none of these kalendars can be relied on, and it therefore seems unnecessary to reproduce them here. Some observations, however, will be found on the subject under the head of the special articles of the vegetable Materia Medica.

The preparing of vegetable substances for preservation is now tolerably well understood in most particulars. It is unnecessary,

therefore, to say much here on the methods usually practised. Seeds ought to be exposed to a moderate heat, and then sifted and winnowed, to remove insects and their ova, with other impurities. Leaves and flowers should be promptly dried in a current of heated air, and out of reach of bright light; and the Dublin College properly directs that leaves, which are used in the state of powder, should be reduced to that form as soon as they are dry, and immediately stored in well-stopped, opaque bottles. This is the most effectual way to preserve them against both damp and insects, and likewise in small space. Even those leaves whose properties are fugacious, such as hemlock leaves, may be thus preserved for years without alteration. Barks are best preserved in drawers or boxes in a dry, well-aired apartment, woods and dry roots in the same manner, but fresh roots in sand in a cellar. Dried fruits are usually preserved in boxes or drawers, sometimes in bottles; but fresh pulpy fruits can be preserved with difficulty in any way. The only important medicinal fruit of this kind, the lemon, is better preserved in fresh carefully slaked lime, within stone-ware jars or bottles, than in any other method I have tried. Vinegar or salt, recommended for the purpose in some pharmaceutic works, may preserve their colour, but not their flavour, nor their own proper acid—as might be inferred from the principles of *endosmosis* and *exosmosis*, established by Dutrochet.——The directions given by the London College for the purification of opium and gum-resins are unnecessary or even injurious. Opium may now be obtained at any time so free of mechanical impurities as not to require the operation of cleaning; and no other quality should be recognised by the Colleges or admitted into the shop of the druggist. The same remark may be applied to the gum-resins. Such impurities as may be removed by the College process are easily detected on examination, and occur only in the inferior qualities of these drugs, now gradually becoming less abundant in the market, and manifestly such as no sensible druggist will admit into his establishment. Besides, the College process cannot be applied without detriment, because a portion of the volatile oil, the most important ingredient of many gum-resins, must be driven off by the heat, more especially in that modification of the process in which the gum is dissolved in boiling water and afterwards recovered by evaporation. It has been lately stated, however, that if the gum-resin be softened by the aid of heat with three-eighths of its weight of proof-spirit, instead of water, it may be dried after expression without loss of volatile oil [Gobley].

VINEGARS.

There are few preparations of this kind in the Pharmacopœias. Nevertheless the state of solution in distilled vinegar is probably one of the best officinal forms for many vegetable drugs, so far at least as energy is concerned. The reason is that acetic acid, even

much diluted, is a powerful solvent of almost all active neutral and alkaloidal principles of the vegetable kingdom, whether pure, or in the compound state in which they are presented by nature.

VOLATILE OILS.

General Directions, *Edin.* Volatile oils are obtained chiefly from the flowers, leaves, fruit, barks, and roots of plants, by distilling them with water, in which they have been allowed to macerate for some time. In order to obtain them profitably and of good quality, a great variety of conditions must be attended to, differing in regard to each, and such as it would be out of place to enumerate here in detail. Certain general principles however may be mentioned.

Flowers, leaves, and fruits generally yield the finest oils, and in largest quantity, when they are used fresh. Many however answer equally well, if they have been preserved by beating them into a pulp with about twice their weight of muriate of soda, and keeping the mixture in well-closed vessels.

Substances yielding volatile oils must be distilled with water, the proper proportion of which varies for each article, and for the several qualities of each. In all instances the quantity should be such as to prevent any of the material from being empyreumatized before the whole oil is carried over. In operations where the material is of pulpy consistence, other contrivances must be resorted to for the same purpose. These chiefly consist of particular modes of applying heat so as to maintain a regulated temperature not much above 212°. On the small scale heat may be thus conveniently applied by means of a bath of a strong solution of muriate of lime, or by means of an oil bath, kept at a stationary temperature with the aid of a thermometer. On the large scale heat is often applied by means of steam under regulated pressure. In other operations it is found sufficient to hang the material within the still in a cage or bag of fine net-work; and sometimes the material is not mingled with the water at all, but is subjected to a current of steam passing through it.

The best mode of collecting the oil is by means of the refrigeratory described (see p. ii.); from which the water and oil drop together into a tall narrow vessel provided with a lateral tube or lip near the top, and another tube rising from the bottom to about a quarter of an inch below the level of the former. It is evident that with a receiver of this construction the water will escape by the lower tube; while the volatile oil, as it accumulates, will be discharged by the upper one, except in the very few instances where the oil is heavier than water.

By attending to the general principles now explained, Volatile oils may be readily obtained of excellent quality from the flowers of *Anthemis nobilis, Lavandula vera,* and *Ruta graveolens;* from the fruit of *Anethum graveolens,* bruised, *Carum Carui,* bruised, *Eugenia Pimenta,* bruised, *Fœniculum officinale,* bruised, *Juniperus communis,* bruised, *Piper Cubeba,* ground, and *Pimpinella Anisum,* ground; from the undeveloped dried flowers of *Caryophyllus aromaticus,* from the tops of *Juniperus communis, Juniperus Sabina,* and *Rosmarinus officinalis,* from the entire herb of *Mentha piperita, M. Pulegium, M. viridis,* and *Origanum Majorana;* and also from the bruised root of *Sassafras officinale.*

General Directions, *Lond.* The fruit of Anise, Carui and Juniper, the flowers of Chamomile, Lavender, and Elder, Pimento-berries, the tops of Rosemary, and the herb of Peppermint, Spearmint, Pennyroyal, and Marjoram,—are to be used entire and fresh.

Each being put into an alembic, it is to be covered with water, and the oil is then to be distilled into a refrigeratory.

General Directions, *Dub.* Essential oils are to be prepared from the seeds of Anise, Caraway, and Sweet-fennel dried with a gentle heat,—from the bark and wood of Sassafras,—from the berries of Juniper and Pimento,—from the flowers of Lavender,—from the leaves and flowers of the inflorescent herb of Peppermint, Spearmint, Marjoram, Pennyroyal, Rosemary, and Rue, and from the leaves of Savin.

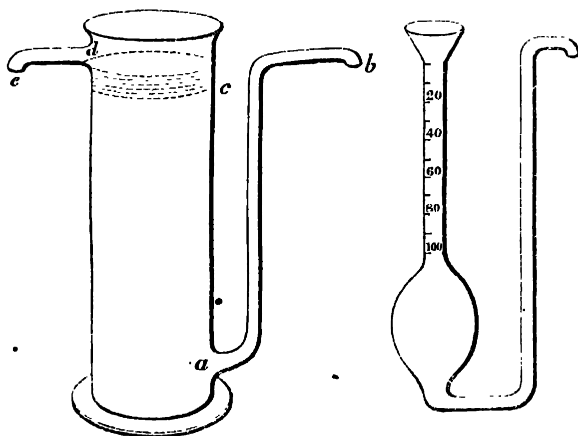
For this purpose, having previously macerated any of them, put it into an alembic; and then, applying a gentle heat by the vapour of boiling water, distil the liquor into a receiver, from which, according as the oil is lighter or heavier than water, it may be separated either at the surface or the bottom by means of a proper apparatus. In distilling the seeds of Caraway and Fennel, the leaves of Peppermint, Spearmint, and Pennyroyal, or the berries of Pimento, the watery fluid which passes over with the oil is to be preserved as directed under the subsequent head. (See *Distilled Waters*).

Volatile oils are contained in cells, generally peculiar, and often so large as to be distinct to the naked eye. Sometimes they exist in such abundance that they may be obtained by mere expression. The oils of lemon, orange, bergamot and citron are prepared in this way by the manufacturer; and from many other substances, such as the unripe germen of rue and the undeveloped corolla of the clove-tree, oils may be squeezed out by pressure with the nail. In some rare instances, as in that of the Liquid Borneo-Camphor from the *Dryobalanops Camphora* and the Laurel-oil of Guiana from a species of *Ocotea*, volatile oil is obtained largely and of considerable purity by exudation from incisions. Much more frequently however it is exuded spontaneously or from incisions as a turpentine in combination with resin, or as a gum-resin in union with both gum and resin. Most frequently of all it cannot be obtained in any of these modes, but adheres with more or less force to the flowers, leaves, fruit, bark, or wood, which contain it. In that case it is sometimes destroyed or dispersed when the plant is dried, more especially if the organ which contains it is the flower; but often, when contained in the leaf, and very generally, if contained in the seed, bark, or wood, it is retained in part or altogether under desiccation, and even under long keeping.—In some instances it appears, that the volatile oil obtained from plants does not exist in them ready formed, but is produced on bruising or distilling them with water, through the reaction of other principles on one another. Of this mode of production two remarkable examples exist in the volatile oils of the bitter-almond and black mustard-seed; and it is probable that the oils of cherry-laurel leaves, peach-leaves, and the leaves of other amygdalaceous plants, are similarly circumstanced.

A few volatile oils used in medicine are obtained by expression, such as the oils of orange, lemon and bergamot, already mentioned. When oils exude along with resin in the form of turpentine, they may be separated from the resin by heat alone, as they are volatilizable about the temperature of 400°. But they cannot be so obtained of fine quality, because the heat required is too near that at which resins, as well as they themselves, undergo decomposition. In general therefore this plan is not followed for pharmaceutic purposes; and volatile oils are obtained from turpentines by distilling them with water. For, although they do not enter into ebullition at the temperature of boiling water, their vapours pass over in large quantity with steam; and condensing along with it, form distilled waters, with volatile oils either floating on the water, or more rarely sinking to the bottom. The volatile oils of many vegetable substances are to be separated in this way alone; because the other principles contained along with them in the crude substance are empyreumatised by the higher temperature which is required to disengage the oil without the co-operation of watery vapour. In some instances it has been thought advantageous to substitute a

strong solution of common salt for water in the still, because a somewhat higher temperature is required to boil it. There seems an advantage in this change for the rectification of oils previously obtained from the raw materials in which they reside; but the advantage in the case of distillation from crude vegetable substances is doubtful.

The method of distilling volatile oils differs little from that described above for preparing distilled waters. The same precautions must be observed in applying heat, and for the same reasons. The formation of mucaginous matter, at the expense of the oil towards the close of the distillation, is shewn by the globules of oil coming over enveloped in a fine pellicle of it. The quantity of water must be proportionally less, or rather, the same portion of water is to be used with repeated successive portions of the material which yields the oil; otherwise a material loss is sustained by solution of the oil in the water. In some instances, where the oil exists in low proportion and is of great value, the distilled fluid should be left at rest for some time, and exposed to as low a temperature as can be commanded. The apparatus delineated in page ii. is the best refrigeratory for the distillation of volatile oils. The most convenient vessel for collecting the oil is that represented below. If the oil be lighter than water, as is generally the case,—the water as it drops



from the refrigeratory into this receiver, escapes by the lower tube *a b*, while the oil accumulates on the surface of the water. Hence, if water be in the first instance poured into the receiver as high as *c*, within a quarter of an inch or less of *d*, it is easy to see that, when the oil accumulates sufficiently, it will drop by the tube *d e*, on closing *b* for a little. When the oil is heavier than water, *b* should be closed till the level of the oil rises above *a*; on the water afterwards rising to *d*, this will escape by *d e*; and the oil may be discharged from *b* by closing *e*, without stopping the distillation.

The right-hand Figure represents a convenient form of this instrument on a small scale for experiments of analysis, the stem being graduated to grains.

The success of the operations of the distiller of volatile oils depends greatly on skill in choosing his materials. The proportion and quality of volatile oils in plants differ materially according to the mode in which they are prepared for distilling, and vary also with numerous circumstances connected with vegetation. It has been already stated that some vegetable substances retain their oil so tenaciously, that they may be both dried and stored for a long time without material loss; that others may be dried without detriment, but cannot be kept long; and that others again cannot be even dried without losing their oil entirely. But the most important sources of variety in productiveness are circumstances affecting vegetation, such as latitude, altitude, exposure, weather, soil, season, and the progress of vegetation. The knowledge at present possessed of the effect of these circumstances is meagre, vague, and incapable of being generalized. It is commonly held to be the result of general observation, that volatile oil is most abundant in each plant in the warmest country where it thrives well,—in a southern exposure,—in bright sunshine weather, with little rain,—in a rather poor soil,—and at the period of inflorescence. Such seems certainly the general rule. But from some experiments I have made on the subject, as part of a more extended inquiry into the causes connected with vegetation which affect the activity of plants, it would appear that the exceptions are numerous, and that more careful researches must be undertaken than any yet instituted.

The following table, shewing the proportion of volatile oil obtained from the chief medicinal vegetable substances, according to the most recent experiments, will be found useful in several ways. Among other things it illustrates several of the general statements now made as to the influence of modes of preparation and circumstances in vegetation upon the quantity of oil. The data are chiefly extracted or calculated from experiments by M. Raybaud in the *Journal de Pharmacie*, xx,—by Dr Martius in *Repertorium für die Pharmacie*, xxxix,—by Dr Bley in the same work, xlviii,—by M. Dann and by M. Voelter in the same work, lv;—and a few have been added from experiments of my own. The numbers represent the number of ounces obtained from 100 pounds avoirdupois. The experiments of the continental authorities were commonly made on the large scale. My own were made on a small scale with the apparatus at page ii, and the graduated receiver at page xxx; and from a comparative trial in one or two instances upon a large scale, I am disposed to give the preference for accuracy to small operations, when they are carefully conducted. The letters before the figures refer to the authority for each.

Amygdalus communis. Bitter almond,	Ra.	0.38
Amygdalus communis. Bitter almond,	Vo.	7.70
Amygdalus communis. Bitter almond (Duflos),	0.8 to	4.80
Angelica Archangelica,—dried root,	Ra.	4.50
Anthemis nobilis,—fresh flowers raised at *Grasse*,	Ra.	0.75
Anthemis nobilis,—dried flowers, do.	Ra.	1.38
Anthemis nobilis,—dried flowers, long kept, *Germany*,	Bl.	4.50
Anthemis nobilis,—flowers fresh dried,	Steer.	5.33
Anthemis nobilis,—flowers 12 months dried,	Steer.	3.0
Apium graveolens,—dried fruit,	Ra.	9.00
Apium Petroselinum,—fresh herb, after flowering,	Ra.	3.38
Apium Petroselinum,—dry fruit, *France*,	Ra.	12.0
Apium Petroselinum,—dry fruit, *Germany*,	Da.	30.0
Artemisia Absinthium,—fresh herb, *Paris*,	Ra.	2.0
Artemisia Absinthium,—dried herb, recent, *Germany*,	Ma.	16.0
Artemisia Absinthium,—dried herb, a year old, *Germany*,	Bl.	8.75
Artemisia Absinthium,—dried herb, 3 years old, *Germany*,	Ma.	5.0
Artemisia —— ? Wormseed of commerce,	Ra.	3.0
Artemisia —— ? Levant wormseed,	Vo.	10.8
Calamus aromaticus,—fresh root, *Germany*,	Ma.	16.0
Calamus aromaticus,—recently dried, *Germany*,	Bl.	17.5
Calamus aromaticus,—long dried, *Germany*,	Da.	14.3
Carum Carui,—dried fruit of French commerce,	Ra.	50.12
Carum Carui,—dried fruit of German commerce,	Ma.	66.5
Carum Carui,— do. do.	Da.	46.6
Carum Carui,— do. do.	Vo.	70.0
Caryophyllus aromaticus. Cloves, *Bourbon*,	Ra.	144.0
Caryophyllus aromaticus. Cloves, *Cayenne*,	Ra.	152.0
Caryophyllus aromaticus. Cloves, do.	Bl.	125.0
Caryophyllus aromaticus. Cloves, *Molucca:* French commerce,	Ra.	118.0
Caryophyllus aromaticus. Cloves, do. English commerce,	Ra.	112.5
Caryophyllus aromaticus. Cloves, average, German commerce,	Vo.	226.0
Caryophyllus aromaticus. Cloves, finest; do.	Da.	250.0
Caryophyllus aromaticus. Cloves; German commerce,	Steer.	272.0
Cinnamomum zeylanicum, cinnamon of commerce,	Ra.	1.56
Cinnamomum Cassia,—cassia bark of commerce,	Ra.	12.0
Citrus Aurantium,—Sweet orange flowers, 1 May, *Nice*,	Ra.	5.0
Citrus vulgaris,—Bitter orange flowers, 7 May, *Nice*,	Ra.	5.9
Citrus vulgaris, do. do. 12 May, *Carmel*,	Ra.	4.12
Citrus vulgaris, do. do. 16 July, *Paris*,	Ra.	0.9
Citrus vulgaris, do. do. 14 Dec. *Paris*,	Ra.	6.5
Citrus Aurantium,—rind of 100 oranges, by expression,	Ra.	2.5
Citrus Aurantium, do. by distillation,	Ra.	2.75
Citrus vulgaris,—rind of 100 oranges, by expression,	Ra.	4.0
Citrus vulgaris, do. by distillation,	Ra.	4.25
Citrus Limetta, rind of 100 limes, by distillation,	Ra.	2.12
Citrus Bergamium, rind of 100 bergamots, by distillation,	Ra.	2.9
Citrus Limonum, rind of 100 lemons, by expression,	Ra.	1.9
Citrus Limonum, do. by distillation,	Ra.	1.4
Cochlearia Armoracia,—fresh seeds,	Ra.	0.9
Coriandrum sativum,—dry fruit of French commerce,	Ra.	2.3
Coriandrum sativum,—dry fruit of German commerce	Da.	9.0
Croton Eleutheria,—cascarilla bark,	Bl.	5.62
Cuminum Cyminum,—dry fruit of French commerce,	Ra.	44.0
Cuminum Cyminum,—dry fruit of German commerce,	Bl.	32.5
Daucus Carota,—dry fruit,	Ra.	0.66
Daucus Carota,—fresh root,	Ra.	0.14
Dracocephalum moldavicum,—flowering herb,	Ra.	2.10
Drimys Winteri,—Winter's bark (probably, however, only Canella alba),	Ra.	0.50
Eugenia Pimenta,—pimenta berries, *Jamaica*,	Ra.	12.38
Fœniculum* officinale,—dry fruit of French commerce,	Ra.	33.0

* It does not appear what is the exact species or variety of fennel understood by the authors of these four experiments, as they use the vague name of *Anethum Fœniculum*.

Fœniculum* officinale,—dry fruit of German commerce,	Ma.	56.6
Fœniculum* officinale, do. German commerce,	Bl.	83.0
Fœniculum* officinale, do. German commerce,	Da.	60.4
Fœniculum officinale,—flowering herb, *Grasse*,	Ra.	4.9
Fœniculum officinale,—herb after flowering, *Grasse*,	Ra.	6.0
Galipea officinalis,—Cusparia-bark of commerce,	Ra.	1.5
Genista canariensis,—Rhodium-wood,	Ra	0.47
Geum urbanum,—dry roots,	Ra.	0.53
Hyssopus officinalis,—flowering herb, *Grasse*,	Ra.	5.30
Illicium anisatum,—star-anise-fruit,	Ra.	34.21
Illicium anisatum,—star-anise-fruit,	Da	25.5
Juniperus communis,—green berries, 12 Sept.	Ra	3.9
Juniperus communis,—ripe berries, 1 Dec. *France*,	Ra.	7.75
Juniperus communis, do. fresh, *Germany*,	Do.	15.5
Juniperus communis, do. a year old, *Germany*,	Ma.	10.8
Juniperus communis, do. a year old, *Germany*,	Bl.	16.25
Juniperus Sabina,—fresh twigs, 5 March, *Grasse*,	Ra.	19.05
Juniperus Sabina,—fresh twigs, 2 Oct. *Paris*,	Ra.	14.25
Juniperus Sabina,—dried twigs, recent, *Germany*,	Ma.	40.0
Juniperus Sabina,—dried twigs, a year old, *Germany*,	Ma.	25.0
Larix Cedrus,—fresh cedar wood, *Paris*,	Ra.	0.3
Larix Cedrus,—cedar wood of commerce,	Ra.	4.25
Laurus nobilis,—fresh leaves, 26 Jan. *Paris*,	Ra.	5.25
Laurus nobilis,—leaves some years dried, *Germany*,	Bl.	4.10
Laurus nobilis,— { fresh leaves, } poor soil, low site,	Chr.	7.33
Laurus nobilis,— { early in Oct. } poor soil, high site,	Chr.	6.9
Laurus nobilis,— { near *Edinb.* } very fine soil, low site,	Chr.	17.12
Lavandula vera,—flowering herb, 2 Aug. *Grasse*,	Ra.	11.5
Lavandula vera, do. 2 Aug. *Grasse*, north exposure,	Ra.	9.12
Lavandula vera,—flowering herb, 26 July, *Soureillas*,	Ra.	9.0
Lavandula vera,—herb after flowering, 26 Sept. *Soureillas*,	Ra.	15.0
Lavandula Spica,—fresh herb, 21 July *Paris*,	Ra.	7.62
Lavandula Spica,—fresh herb, 4 Aug. *Grasse*,	Ra.	12.5
Lavandula Stoechas,—dried spikes,	Ra.	6.43
Ligusticum Levisticum,—fresh herb, *Paris*,	Ra.	1.12
Melissa officinalis,—fresh flowering herb,	Ra.	0.25
Mentha piperita,—fresh tops in flower, *Grasse*,	Ra.	6.25
Mentha piperita,—fresh tops in flower, *Paris*,	Ra.	3.40
Mentha piperita,—dried tops in flower, *Germany*,	Bl.	15.62
Mentha piperita,—dried tops in flower, *Germany*,	Ma.	21.0
Mentha Pulegium,—fresh flowering herb,	Ra.	1.0
Myristica moschata,—mace of commerce, finest,	Vo.	154.0
Myristica moschata, do. fine,	Bl.	125.0
Myristica moschata, do. worm eaten,	Bl.	65.6
Myristica moschata,—nutmegs of commerce, fine,	Bl.	108.25
Myristica moschata, do. worm eaten,	Bl.	64.1
Myrtus communis,—fresh leaves, September 20—*Grasse*,	Ra.	4.5
Myrtus communis,—fresh leaves, September 6—*Paris*,	Ra.	2.5
Origanum Majorana,—fresh flowering herb, August 3,—*Grasse*,	Ra.	8.5
Origanum Majorana,—fresh flowering herb, August 3,—*Paris*,	Ra.	4.4
Origanum vulgare,—fresh flowering herb, September 15,—*Paris*,	Ra.	0.4
Pimpinella Anisum,—dry fruit of French commerce,	Ra.	35.12
Pimpinella Anisum,—dry fruit, new,—German commerce,	Ma.	37.5
Pimpinella Anisum,—dry fruit, old,—German commerce,	Ma.	27.0
Pimpinella Anisum,—dry fruit of German commerce,	Vo.	25.0
Pimpinella Anisum, do. do.	Da.	43.75
Piper Cubeba,—Cubebs of French commerce,	Ra.	19.5
Piper nigrum,—White pepper of do.	Ra.	16.0
Piper nigrum,—Black-pepper of do.	Ra.	18.12
Prunus Lauro-cerasus,—fresh leaves, November 23,—*Paris*,	Ra.	2.12

* See note in last page.

Prunus Lauro-cerasus fresh leaves undeveloped, June 7, -	Chr.	10.13
Prunus Lauro-cerasus from the same half-grown, June 7,	Chr.	7.20
Prunus Lauro-cerasus plants: near full-gr. 8 weeks on tree, July 15,	Chr.	4.96
Prunus Lauro-cerasus *Edinburgh*, 12 months on tree, June 2,	Chr.	1.04
Prunus Lauro-cerasus Fresh leaves of the same 3 mo. on the tree,	Chr.	7.04
Prunus Lauro-cerasus plant, 1 Sept. 1836, *Edin.* 15 mo. on the tree,	Chr.	2.24
Renealmia Cardamomum,—lesser cardamoms, -	Ra.	11.42
Rosa centifolia, fresh flowers, *Grasse*, - -	Ra.	0.25
Rosmarinus officinalis,—fresh flowering herb, *Grasse*, -	Ra.	5.0
Rosmarinus officinalis, do. *Paris*, -	Ra.	3.5
Ruta graveolens, fresh flowering herb, 20 July, *Grasse*, -	Ra.	4.12
Ruta graveolens, do. 28 July, *Paris*, -	Ra.	0.63
Ruta graveolens, flowering herb, newly dried, *Germany*, -	Bl.	4.4
Ruta graveolens,—dried seeds, *South of France*, - -	Ra.	19.0
Salvia officinalis, v. *minor*,—fresh herb, 12 Mar. *Grasse*, -	Ra.	6.0
Salvia officinalis, v. *minor*,—fresh herb, 14 June, *Paris*, -	Ra.	2.5
Salvia officinalis, v. *major*,—fresh herb, 12 Mar. *Grasse*, -	Ra.	4.0
Salvia officinalis, v. *major*,—fresh herb, 11 June, *Paris*, -	Ra.	3.05
Santalum album,—sandal wood of commerce, -	Ra.	5.0
Sinapis nigra,—black-mustard-seed, *Germany*, 12 months old, -	Da.	3.9
Sinapis nigra,—black-mustard-seed, *Germany*, fresh, -	Da.	5.0
Sinapis nigra,—black-mustard-seed, *France*, fresh, -	Da.	7.75
Sinapis nigra,—black-mustard-seed, *France*, -	Vo.	9.1
Tanacetum vulgare,—fresh flowering herb, 9 July, *Grasse*, -	Ra.	1.2
Tanacetum vulgare,—fresh flowering herb, 25 July, *Paris*,	Ra.	5.8
Tanacetum vulgare,—fresh tops, *Germany*, - -	Da.	5.0
Tanacetum vulgare,—dried flowering herb, *Germany*, -	Bl.	15.6
Thuya occidentalis, fresh Aged, stunted tree; exposed. Oct. 21,	Chr.	10.8
Thuya occidentalis, twigs Aged, vigorous; sheltered. Oct. 21,	Chr.	10.25
Thuya occidentalis, near Young, vigorous; exposed. Oct. 9,	Chr.	18.25
Thuya occidentalis, *Edin.* Young, vig; exposed; fine soil. Sept. 26,	Chr.	26.40
Thymus Serpyllum,—fresh flowering herb, 6 Aug. *Grasse*, -	Ra.	5.0
Thymus Serpyllum,—fresh flowering herb, 5 July, *Paris*, -	Ra.	0.9
Thymus vulgaris,—fresh flowering herb, 16 Aug. *Grasse*, -	Ra.	6.5
Thymus vulgaris,—fresh flowering herb, 13 July, *Paris*, -	Ra.	3.75
Valeriana officinalis,—dry root, a year old, *Germany*, -	Bl.	30.16
Valeriana officinalis,—the root, *Germany*, - -	Da.	15.0
Valeriana officinalis,—the root, *Germany*, - -	Vo.	10.5
Verbena odorata,—fresh flowering herb, *Paris*, -	Ra.	3.1
Zingiber officinale,—dry root of commerce, - -	Ra.	10.8

The facts in the preceding table seem to show that the flowers of *Anthemis nobilis*, the berries of *Juniperus communis*, and the root of *Acorus Calamus* may be both dried and long kept, without material loss of volatile oil; but that the herb of *Artemisia Absinthium* and the tops of *Juniperus Sabina*, though they may be dried, cannot be long preserved, without loss. It farther appears that the seed of *Sinapis nigra* cannot be long kept without material loss; and that the mace and kernel of *Myristica moschata* suffer greatly in their proportion of oil, when attacked by worms. The influence of season is well exemplified in the case of the flowers of *Citrus Aurantium*, which is well known to flower at different periods of the year. The effect of climate is equally well shown in many examples, such as the wood of *Larix Cedrus*, the herb or flowering tops of *Lavandula vera, Lavandula Spica, Mentha piperita, Myrtus vulgaris, Origanum Majorana, Rosmarinus officinalis, Thymus Serpyllum, Thymus vulgaris, Tanacetum vulgare*, and the seeds of *Sinapis nigra*. Under this head, the great

superiority of Grasse in the south of France over Paris for raising plants for distilling oils, is remarkable. The effect of soil or site is exhibited in my own experiments with the leaves of *Laurus nobilis* and *Thuya occidentalis*; and that of the progress of vegetation is excellently shown in the instances of the herb of *Fœniculum officinale* and *Lavandula vera*, the berries of *Juniperus communis*, but above all, the leaves of *Prunus Laurocerasus*. Farther, the table presents many examples, but especially under *Caryophyllus aromaticus*, *Carum Carui*, *Coriandrum sativum*, and *Illicium anisatum*, of great differences prevailing in the relative proportion of volatile oil, and consequently in relative activity, between different specimens of the same vegetable substance as it occurs in ordinary commerce. In conclusion it should be observed, that the circumstances most favourable to the proportion of volatile oil are not necessarily always most favourable to its quality. Raybaud mentions, that the cloves of English commerce, which will be seen (*Caryophyllus aromaticus*) from the table to have furnished the lowest proportion of oil, produce it of finer quality than other kinds he examined. And lavender, which yields considerably more volatile oil after flowering than during inflorescence (*Lavandula vera*), produces in the latter case an oil of more delicate fragrance than in the former; and it is not so acrid.

Volatile oils should be preserved in dark bottles carefully closed and nearly full. For otherwise they absorb oxygen, deposit resin, and become turbid, losing at the same time the purity and richness of their aroma. When they have been thus altered, they may often be much improved in quality by agitating them with animal charcoal recently heated. Their clearness is thus at once restored, and the purity of their fragrance in a great measure recovered. The same method will also remove adhering water, which is injurious to some oils.

WEIGHTS AND MEASURES.

The system of weights recognised in the British empire by legislative enactment since 1826, are two in number, Troy and Avoirdupois Weight. The fundamental denomination is the Troy-pound, consisting of 5760 grains. Seven thousand such grains constitute the pound Avoirdupois. The Troy-pound is divided into twelve equal parts, called Ounces, and each ounce into twenty parts called Pennyweights; the former of which therefore contains 480, and the latter 24 grains. The avoirdupois-pound, or, as it is now more commonly called, the Imperial-pound, is divided into sixteen parts, called Ounces, each of which is divided into sixteen parts or Drachms; so that the avoirdupois-ounce contains 437.5 grains, and the drachm of the same denomination 27·34375 grains troy.

The system of measures recognised at the same time is called Imperial measure. Its standard denomination is the Gallon, which

contains ten avoirdupois-pounds of distilled water, weighed at the temperature of 62° F., and the barometric pressure of 30 inches. The gallon is divided into eight parts, called Pints; each of which therefore contains twenty avoirdupois-ounces of water.

These weights and measures are permanently fixed by reference to the length of a pendulum swinging seconds in the latitude of London at the temperature of 62° F., and at 30 inches of barometric pressure. A troy-pound and yard-measure, having been selected from among those which had been long recognised in practice as national standards, it was found, that on the former being divided into its constituent 5760 grains, and the latter into 36 linear parts, or inches,—252.458 grains of water, at the temperature of 62° and barometric pressure of 30 inches, were exactly contained in a cubic inch; and the length of the seconds' pendulum was 39.1393 linear inches. These being invariable facts, the standards of the realm may be preserved invariable by reference to them.

The system of weights and measures used in medicine and pharmacy, though based on the imperial standards, is yet in some respects essentially different. The troy-pound and ounce are adopted in the pharmaceutic system of weights; but the ounce, instead of consisting simply of pennyweights, is divided into eight parts of 60 troy-grains each, and these are termed drachms; and the drachm is subdivided into three parts of 20 grains, called scruples. This system is called Apothecaries'-weight.

For a long time the Royal Colleges of Physicians in the three kingdoms declined to recognise the use of measures in preparing and dispensing medicines,—on the ground that the varying densities of different fluids rendered it difficult to use one common measure for all without risk of serious errors. But as druggists and medical practitioners constantly employed measures, in defiance of the prohibition, and the practice, besides being attended with great and obvious convenience, was found to be less fraught with danger than had been conceived, the London College in the first instance, and subsequently the other colleges also, recognised a system of measures of their own, founded on the standard measures of the country. The Colleges of London and Edinburgh, adopting the Imperial pint of 1826 as the basis, divide it into twenty parts, called Fluidounces; each of which corresponds exactly with an avoirdupois-ounce of distilled water at 62° F. and 30 B., and therefore contains 437.5 grains troy. The fluidounce is subdivided into eight parts of 54.6875 grains, termed Fluidrachms; and each of these consists of sixty parts, called Minims, which therefore amount each in weight to 0.91146 troy-grain of distilled water.

The last edition of the Dublin Pharmacopœia having been published immediately before the passing of the Act of 1826, the Imperial standard measure could not be adopted in that work as the basis of Apothecaries' measure. The College however recognised

a system adopted in a previous edition of the London Pharmacopœia, and founded on the Wine-measure, now proscribed, but in general use in Britain prior to the legislative alterations of 1826. According to this system, the old-wine-gallon of 231 cubic inches, or 58317.8 troy-grains of distilled-water at 62° F. and 30 B., is divided into eight "Pounds by measure" or old-wine-pints, each containing 7289.725 grains of water. The pint is subdivided into sixteen "ounces by measure," containing each 455.6075 grains; the ounce is divided into eight "drachms by measure" of 56.95 grains each; and the drachm is divided into three "scruples by measure," each of which contains nineteen grains troy, and consists of twenty "grains by measure." Care must be taken therefore not to confound the Dublin apothecaries' measure with that more recently adopted by the two British Colleges.

The several denominations of weights and measures now in use in the three kingdoms may be conveniently represented thus.

Imperial Weight.

Ton.		*Hundredweight.*		*Stone.*		*Pound.*		*Ounce.*		*Drachm.*		*Grain.*
1	=	20	=	160	=	2240						
		1	=	8	=	112						
				1	=	14						
						1	=	16	=	256	=	7000
								1	=	16	=	437·5
										1		27·34375

Troy Weight.

Pound.		*Ounce.*		*Pennyweight.*		*Grain.*
1	=	12	=	240	=	5760
		1	=	20	=	480
				1	=	24

Apothecaries' Weight.

Pound.		*Ounce.*		*Drachm.*		*Scruple.*		*Grain.*
1	=	12	=	96	=	288	=	5760
		1	=	8	=	24	=	480
				1	=	3	=	60
						1	=	20

Imperial Measure.

Quarter.		*Bushel.*		*Peck.*		*Gallon.*		*Quart.*		*Pint.*		*Cubic inch.*		*Imp. lbs.*		*Troy grains.*
1	=	8	=	32	=	64	=	256	=	512	=	„		640		„
		1	=	4	=	8	=	32	=	64	=	„		80		„
				1	=	2	=	8	=	16	=	„		20		„
						1	=	4	=	8	=	277·274	=	10	=	70,000
								1	=	2	=	69·3185	=	2·5	=	17,500
										1	=	34·65925	=	1·25	=	8,750

Apothecaries' Measures.

1. *London and Edinburgh.*

Gallon.		*Pint.*		*Fluidounce.*		*Fluidrachm.*		*Minim.*		*Imperial weight.*		
1	=	8	=	160	=	1280	=	76800	=	70000 *grs.*	=	10 *lbs.*
		1	=	20	=	160	=	9600	=	8750	=	1·25
				1	=	8	=	480	=	437·5	=	1 *oz.*
						1	=	60	=	54·7		„
								1	=	0·91		

2. *Dublin.*

Gal.	*Pound.*	*Ounce.*	*Drachm.*	*Scruple.*	*Grain.*	*Imperial weight.*	
1 =	8 =	128 =	1024 =	3072 =	61440	= 58317·798 *grs.*	= 8·331 *lbs*
	1 =	16 =	128 =	384 =	7680	= 7289·725	= 1·041
		1 =	8 =	24 =	480	= 455·6075	= 1·041 *oz.*
			1 =	3 =	60	= 56·95	"
				1 =	20	= 18·918	"
					1	= 0·95	"

When the Act for establishing the Imperial Weights and Measures was passed in 1826, the medical profession was exempted from its operation, on account of the supposed risk of error in dispensing active drugs by the new standard. Many competent authorities however have called in question the propriety of the exemption; in this part of the kingdom a general feeling prevails against it among medical practitioners as well as druggists; and a declaration to this effect has been made by the Edinburgh College of Physicians in the last editions of the Edinburgh Pharmacopœia in 1839 and 1841. The exemption has always appeared to me impolitic,—and for three reasons. For in the first place, the retention of the present denomination of weights involves a troublesome want of correspondence between the weights and measures employed in medicine. Secondly, notwithstanding the permission granted by the Legislature, and contrary to what has been generally supposed by practitioners, druggists actually do not follow the apothecaries' system of weights except for low denominations. Some indeed make a difference between their general sales and the execution of physicians' prescriptions, by following the Apothecaries'-weight throughout for the latter. But many even in compounding prescriptions, and most of them in other departments of their business, adhere to this weight only so far as regards the drachm and inferior denominations, but use imperial weights for the ounce and all denominations above it. Many druggists even take the trouble of keeping a book of the College Formulæ, in which, to suit the practice now mentioned, the proportions of the materials are altered from those in the Pharmacopœia. Important deviations from the original formulæ have thus arisen, in consequence of erroneous calculations, founded more especially on neglect of the varying densities of liquids. Druggists in Ireland prevalently practise a still more complex system. For in the measurement of liquids they follow the standard of the Dublin College, if the article be an active medicine; while for aqueous fluids of little energy they adopt the denominations of the old Irish gallon of 217·6 cubic inches, because phials are made according to that standard. Thirdly, the circumstance, that druggists have generally abandoned in practice the higher denominations of Apothecaries' weight, seems to do away in a great measure with the objection of risk of error from adopting the Imperial weights.

Besides the standard and precise measures recognised by the Colleges, others of a less exact nature are in general use for the

administration of medicines. These are the glass-tumbler, breakfast-cup, tea-cup, wine-glass, table-spoon, dessert-spoon, tea-spoon, drop, quart-bottle, and pint-bottle. All such measures are approximative only. The tumbler commonly holds eight fluidounces, the breakfast-cup about as much, the tea-cup five fluidounces, the wine-glass two fluidounces, the table-spoon half a fluidounce, the dessert-spoon two fluidrachms, and the tea-spoon one fluidrachm. As to the drop, this varies so much with a variety of circumstances, that all pharmacologists agree in recommending its abandonment in practice. But it is so convenient, especially in the sick-room, that it will probably be always employed. The size of a drop varies somewhat with the form of the bottle, still more with the rapidity of the measurement, but most of all with the viscidity or cohesiveness of the liquid. The following estimate of the weight of the drops of various common liquids is taken from tables in Dr Duncan's Dispensatory. Sixty drops of water weigh 60 grains,—of weak watery solutions a trifle less,—of white wine 38 grains,—antimonial and ipecacuan wine 43,—proof-spirit 23,—rectified-spirit 20,—laudanum 24,—tincture of digitalis 24,—sulphuric-ether 17,—olive oil 27,—acetic acid 29,—oil of peppermint 31,—oil of cloves 38,—sulphuric acid 58,—syrup 72. The quart-bottle and pint-bottle are often confounded with the quart and pint of the Imperial measure; but they are essentially different, the former containing about 26½ fluidounces only, and the latter about thirteen.

The different denominations of weights and measures are denoted in the language of Prescriptions by the following signs:

Pound, ℔. Ounce, ℥. Drachm, ʒ. Scruple ℈. Grain, gr.
Gallon, C. Pint, O. Fluidounce, fl.℥. Fluidrachm, fl.ʒ.
Minim, ♏.

To these observations on the Standard and Medicinal Weights and Measures of the British Empire, it may be useful to add a few illustrations of those of other countries.

In France since 1840 no other system of weights and measures is allowed to be used either in medicine or in trade generally, except the Metrical system; which, on account of its beauty and extreme convenience in practice, deserves particular notice.

The Metrical system is founded on the length of an arc of the meridian. The ten-millionth part of one quarter of the meridional circumference of the earth is the unit of the French measure of length. This is called a Metre. At the temperature of 32° F. it is equal to 39·371 English inches at 62°. Its multiples are the Decametre, Hectometre, Kilometre, and Myriametre, each of which is ten times the length of the denomination immediately preceding it. The myriametre is equal to nearly six English miles and a quarter. The inferior denominations of the metre are the Decime-

tre, Centimetre, and Millimetre, the last of which is about four-hundredths (0·04) of an English inch.—The unit of measure is a cubic decimetre. It is called a Litre; and is equivalent to very nearly one imperial pint and three-quarters. The unit of weight is a cubic centimetre of distilled water at the temperature of 39°.5 F. at which the density of water is greatest. This is called a Gramme; and it is equal to about 15½ Troy grains. The several denominations of weights and measures, with their equivalent values in the English standards, are as follows:

French Measures.

Millitre	=	*Eng. Cub. in.* .0610	=	16.3 min. Brit. Apoth. Meas.
Centilitre	=	.6103	=	2.705 fl. drs Do.
Decilitre	=	6.1028	=	3.381 fl. oz. Do.
Litre	=	61.028	=	1.7608 Imp. Pint.
Decalitre	=	610.28	=	2.201 Imp. Gal.
Hectolitre	=	6102.8	=	22·01 Do.
Kilolitre	=	61028.0	=	27.51 Imp. Bushel.
Myrialitre	=	610280.0	=	34.39 Imp. Quarter.

French Weights.

Milligramme	=	.0154 grs. English Troy.		
Centigramme	=	.1513 grs. Do.		
Decigramme	=	1·5434 grs. Do.		
Gramme	=	15.434 grs. Do.		
Decagramme	=	154.3402 grs.	=	5.65 drs. Imp. Weight
Hectogramme	=	1513.4023 grs.	=	3.527 oz. Imp.
Kilogramme	=	15434.0234 grs	=	2.205 lbs. Imp.
Myriagramme	=	154340.2311 grs.	=	22.047 lbs. Imp.

The following Tables represent the several denominations of medicinal weights used in some of the principal countries in continental Europe. The value of these denominations varies in different countries according to the value of the grain which constitutes their fundamental weight. Their value in English Troy-grains is therefore given in the third table, the particulars of which I have calculated chiefly from data supplied by M. Soubeiran in the edition of his Traité de Pharmacie in 1840.

I. *Spanish, Tuscan, Roman, and Old French Medicinal Weights.*

Pound.	=	*Ounce.*	=	*Drachm.*	=	*Scruple.*	=	*Grain.*
1	=	12	=	96	=	288	=	6912
		1	=	8	=	24	=	576
				1	=	3	=	72
						1	=	24

II. *Austrian, German, Russian, Prussian, Dutch, Belgian, Swedish, Piedmontese, and Venetian Medicinal Weights.*

Pound.	=	*Ounce.*	=	*Drachm.*	=	*Scruple.*	=	*Grain*
1	=	12	=	96	=	288	=	5760
		1	=	8	=	24	=	480
				1	=	3	=	60
						1	=	20

III. *Value of Continental Medicinal Weights in Troy Grains.*

	Pound.	*Ounce.*	*Drachm.*	*Scruple consisting of* 24 *med.grs.*	*Scruple consisting of* 20 *med.grs.*	*Grain.*
French, .	5670.5	472.50	59.10	19.7		0.820
Spanish, .	5320.4	443.49	55.44	18.47		0.769
Tuscan, .	5240.3	436.67	54.58	18.19		0.758
Roman, .	5235.0	436.25	54.53	18.17		0·757
Austrian, .	6495.1	541.25	67.65	——	22·55	1.127
German, .	5524.8*	460.40	57·55	——	19.18	0.960
Russian, .	5524.8	460.40	57.55	——	19.18	0.960
Prussian, .	5415.1	451.26	56.40	——	18.80	0.940
Dutch, .	5695.8	474.64	59.33	——	19.78	0.988
Belgian, .	5695.8	574.64	59.33	——	19.78	0.988
Swedish, .	5500.2	458.34	57.29	——	19.09	0.954
Piedmontese,	4744.7	395.39	49.45	——	16·48	0.824
Venetian, .	4661.4	388.45	48.55	——	16.18	0.809

In most of the German States the Pound of ordinary trade (Civil-pfund) consists of sixteen ounces, each very nearly of the same value with the medicinal ounce; and consequently it contains 7680 German grains. The Prussian Civil and Medicinal pounds are exactly related in this manner to one another. The Civil-pound consists of 32 *Loth* or half-ounces, and the Loth contains 4 *Quentchen*, which correspond exactly or very nearly with the medicinal *Drachme* or Drachm. The old French Poids-de-Marc pound, used in ordinary trade before the metrical system was established, bears the same ratio to the old French medicinal pound as the civil to the medicinal pound in the German States, and consequently consists of 9216 Poids-de-marc grains, or 7560.6 Troy-grains.

The intercourse of British practitioners with India would render it an object of interest to append here a view of the weights used in native medical practice in that country. The only accounts we yet possess of the subject however are unsatisfactory. Different systems are followed in different districts. Sir Whitelaw Ainslie has given, on the authority of a Tamool physician, the several weights used by native doctors in Lower India, and the equivalent values of some of the denominations in English weights. The following table is constructed from these data; and the English equivalents are calculated on the assumption that the usual estimate of the Parum or Candy, at 500 Imperial-pounds, is correct.

	Maunds.	*Viss.*	*Seers.*	*Pollams.*	*Star Pagodas*	*Gold Fanams.*	*Paddies.*	
1 Parum =	20 =	160 =	220 =	6,400 =	64,000 =	640,000 =	10,240,000 =	500 *Imp. lbs.*
1 Maund =		8 =	11 =	320 =	3,200 =	32,000 =	512,000 =	25 *Do.*
1 Viss =			1.6 =	40 =	400 =	4,000 =	64,000 =	3.125 *Do.*
1 Seer =				25 =	250 =	2,500 =	40,000 =	2.273 *Do*
1 Pollam =					10 =	100 =	16,000 =	1.25 *Imp. oz.*
1 Star Pagoda =						10 –	160 =	2.0 *Imp. drs*
1 Gold Fanam =							16 =	5.47 *Tr. grs*
1 Paddy = A pickle of rice in the husk –							1 =	0.3418 *gr*

Ainslie however says the Star-Pagoda was held by his Tamool friend to be exactly equivalent to four Apothecaries' scruples or 2.925 Imperial drachms, the Gold-Fanam to 8 Troy-grains, and the Paddy to 0.5 grain. I cannot understand the cause of these discrepancies, more especially as the English values assigned to the different Indian weights by the Tamool are inconsistent with one another. Ainslie thinks his friend over-estimated the English weight of the Indian Paddy, or unhusked rice-pickle, and values it himself from actual trial at 0.4 only of a Troy-grain. An experiment I made with 100 pickles in the husk, from Calcutta, and in excellent order, gave 0.365 for the value of the Paddy. None of all these estimates however will bear out the common valuation of the Parum or Candy at 500 Imperial Pounds. The Tamool's estimate would make it 731.4 pounds; Ainslie's 587.1; and my own, although the nearest of all, would make it 533.9 pounds.

WINES.

Wine was at one time a favourite menstruum with pharmacologists for many vegetable and even some mineral articles of the Materia Medica. But it is now less frequently employed, in part because many medicated wines are apt to spoil, and partly because proof-spirit is on the whole a more active solvent. The wine always employed in this country is sherry, which contains about 33 per cent of proof-spirit by volume.

MATERIA MEDICA.

ABIETIS RESINA, *L.* See *Terebinthina.*

ABSINTHIUM. *Herb of Artemisia Absinthium.*

EXTRACTUM ABSINTHII, D.

PROCESS, *Dub.* To be prepared according to the general directions for the preparation of Extracts. See *Introduction.*

FOR. NAMES. *Fr.* Absinthe.—*Ital.* Assenzio.—*Span.* Axenjo.—*Port.* Losna.—*Ger.* Wermuth.—*Dut.* Alsem.—*Russ.* Polin.

FIGURES of Artemisia Absinthium in Hayne, ii. 11.—Engl. Bot. 1230.—Steph. and Ch. ii. 58,—as Absinthium officinale in Nees von E. 235.

THE Artemisia Absinthium, or Wormwood of vernacular speech, has been used in medicine since the days of the Greek physicians, being considered to have been the Ἀψίνθιον of Hippocrates and Dioscorides.

Natural and Chemical History.—It belongs to the Linnæan class and order *Syngenesia Polygamia-superflua*, and to the natural family *Compositæ*, subdivision *Corymbiferæ*, of Decandolle, and to the *Asteraceæ* of Professor Lindley. By Gärtner and others it has been detached from the genus Artemisia, and made to constitute a distinct genus, with the name *Absinthium Officinale*, or *Abs. vulgare.* Wormwood grows abundantly in the south of Europe, and is also met with on roadsides and rubbish-heaps in Britain; but the druggist in this country is supplied with it chiefly from gardens near London. It is easily distinguished from other Artemisias by its pendulous heads and silky calyx. It has a perennial root. The lower part of the stem survives several years, and sends up annually several shoots between two and five feet high, which wither on the arrival of winter. The officinal parts are the leaves, flowering heads, and young twigs. The proper season for collecting it is in July and August, before the flowers run to seed. Most parts of the plant,—the flowers, leaves, and bark of the branches and upper stem,—possess a powerful, penetrating, not agreeable odour, and a strong, aromatic, very bitter taste: but the bark of the lower part of the stem possesses the peculiar odour and aromatic taste without bitterness. Both its taste and odour are long preserved in the dried plant. Wormwood imparts its aroma and bitterness to

water and rectified spirit, as well as to weaker spirits and wines. The aroma is almost lost in preparing an extract from either the watery or alcoholic infusion; but the intense bitterness is retained, as in the *Extractum Absinthii*, D. Its chief proximate principles, in reference to its virtues, are, according to an analysis by Braconnot, 30 parts in one thousand of a bitter, azotiferous extract, 2·4 of an intensely bitter resinous matter, and 1.5 of a dark-green volatile oil, which possesses the peculiar penetrating odour of the plant. Caventou has obtained from the plant a neutral, bitter substance, obscurely crystalline, apparently its active principle, and therefore termed by him Absinthin.

Actions and uses.—Wormwood, as a powerful aromatic bitter, is tonic, in some measure febrifuge, and likewise anthelmintic in its action. On account of these properties it was once highly prized in medicine. It is now chiefly employed as a stomachic bitter in dyspepsia; more however in domestic than in regular practice, at least in this country. There seems no reason for the present neglect of it, except the caprice of fashion, which has gradually substituted other bitters. It is an appropriate stomachic for those whose stomachs have been enfeebled by intemperance. It is one of the many bitter vegetables by which intermittent fever may be sometimes checked. Though advantage has been derived from it in worms, it is inferior in certainty to other anthelmintics. It appears to be absorbed into the system when swallowed; at least the milk and flesh of animals fed with it are said to become bitter. It is generally given in the form of extract. But if the preservation of its aroma be desired, as well as its bitterness, an infusion or tincture is preferable. An infusion of proper strength may be made with half an ounce to a pint of water. A tincture or distilled spirit constitutes the *Eau* or *Crême d'Absinthe* of the continent, much in request among persons addicted to the pleasures of the table. This is prepared by infusing one part of chopped wormwood in four parts of proof-spirit, and distilling off three parts and a-half with a vapour-bath heat.

The dose of the *Extractum Absinthii*, D. the sole officinal preparation is gr. x. *ad.* scr. i.

ACACIA. See *Gummi-Arabicum.*

ACACIA CATECHU, *D.* See *Catechu.*

ACETOSELLA, *L.* *Herb of Oxalis Acetosella, L. W. DC. Spr. Wood-sorrel.*

FOR. NAMES. *Fr.* Alleluia.—*Ital.* Alleluja.—*Span.* Acedera silvestre.—*Port.* Azedinha.—*Ger.* Sauerklee.—*Dut.* Klaverzuuring.—*Russ.* Saitschaitschawl.

FIGURES of Oxalis Acetosella in Nees von E. 385.—Hayne, v. 39.—Steph. and Ch. i. 63.—Engl. Bot. 762.

THE Oxalis Acetosella is a small herbaceous plant with a perennial root, one of the prettiest and earliest of our indigenous

flowers, abounding chiefly in woods, and easily known by its ternate, clover-like leaves, and its pale lilac, bell-shaped flowers, veined with purple lines. It belongs to the natural family *Geraniaceæ*, or its division *Oxalideæ*, and to Linnæus's class and order *Decandria Pentagynia*. The leaves have a pleasant acid taste, strongest in spring, weaker and united with some bitterness in autumn. Their acidity is impaired by drying and keeping them. It depends on binoxalate of potash, which may be extracted to the amount of two ounces and a-quarter of pure salt, and rather more of an impure crystalline mass, from twenty pounds of leaves (Neumann). Wood-sorrel was at one time in use for preparing binoxalate of potash, but has been abandoned for that purpose since the discovery of the conversion of sugar into oxalic acid by the action of nitric acid.

In the form of infusion wood-sorrel leaves are still used in domestic practice, and were once in request in regular practice also, as a refrigerant drink in fever, and an antiscorbutic in scurvy. They are now little employed, and in this part of the kingdom never. The plant is a needless article of the Materia Medica.

ACETUM. See *Acidum Aceticum*.

ACIDUM ACETICUM, *E.* *Acetic acid.*

TESTS, *Edin.* Density not above 1068.5, and increased by 20 per cent of water; colourless; unaltered by sulphuretted-hydrogen or nitrate of baryta; one hundred minims neutralize at least 216 grains of carbonate of soda.

PROCESS, *Edin.* Take of acetate of lead any convenient quantity: heat it gradually in a porcelain basin by means of a bath of oil or fusible metal (8 tin, 4 lead, 3 bismuth,) to 320° F.; and stir till the fused mass concretes again: pulverise this when cold, and heat the powder again to 320°, with frequent stirring, till the particles cease to accrete. Add six ounces of the powder to nine fluidrachms and a-half of pure sulphuric acid contained in a glass matrass; attach a proper tube and refrigeratory; and distil from a fusible metal bath with a heat of 320° to complete dryness. Agitate the distilled liquid with a few grains of red oxide of lead to remove a little sulphurous acid, allow the vessel to rest for a few minutes, pour off the clear liquid and redistil it. The density is commonly 1063 to 1065, but not above 1068.5.

ACIDUM ACETICUM CAMPHORATUM, E. D.

PROCESS, *Edin.* Take of
Camphor half an ounce;
Acetic acid six fluidounces and a half.
Pulverise the camphor with a little rectified spirit, and dissolve it in the acetic acid.

ACIDUM ACETICUM, *D.* *Acetic acid slightly diluted.*

PROCESS, *Dub.* Take of
Acetate of potash one hundred parts,
Sulphuric acid fifty-two parts.
Pour the acid into a tubulated retort: add gradually the acetate, waiting after each addition till the mixture cools; distil with a moderate heat to dryness. Density of the product 1074.

ACIDUM ACETICUM CAMPHORATUM, D.

PROCESS, *Dub.* To be prepared with the Dublin acetic acid in the same way as the corresponding Edinburgh preparation.

ACIDUM ACETICUM, *L.* *Acetic acid moderately diluted.*

TESTS, *Lond.* Density 1048 at 62°: one hundred grains saturate eighty-seven of

carbonate of soda, and the fluid gives by evaporation crystals of acetate of soda: entirely vaporizable: acetate of lead, nitrate of silver, or iodide of potassium, does not affect it: sulphuretted-hydrogen or ammonia does not alter its colour: digested with a silver plate, the liquid does not precipitate with hydrochloric acid.

Process, *Lond.* Take of
Acetate of soda two pounds;
Sulphuric acid nine ounces;
Water nine fluidounces.

Add to the acetate in a retort the acid previously diluted with the water: distil from a sand-bath, carefully regulating the heat towards the end.

ACIDUM PYROLIGNEUM, *E.* *Diluted acetic acid obtained by the destructive distillation of wood.*

Tests, *Edin.* Nearly or entirely colourless; density at least 1034; one hundred minims neutralize at least fifty-three grains of carbonate of soda; unaffected by sulphuretted-hydrogen or solution of nitrate of baryta.

ACETUM BRITANNICUM, *E.* *British vinegar.*

Tests, *Edin.* Density 1006 to 10019; sulphuretted-hydrogen does not colour it; in four fluidounces complete precipitation takes place with thirty minims of solution of nitrate of baryta. (See Tests, Edin. Phar. and *Introduction.*)

ACETUM GALLICUM, *E.* ACETUM VINI, *D.* *French, or Wine, vinegar.*

Tests, *Edin.* Density 1014 to 1022; ammonia in slight excess causes a purplish muddiness, and slowly a purplish precipitate: in four fluidounces complete precipitation takes place with thirty minims of solution of nitrate of baryta. (See Tests in *Introduction.*)

ACETUM, *L.* *Vinegar, prepared by fermentation.*

Tests, *Lond.* Yellowish; of peculiar odour; a fluidounce saturates sixty grains of carbonate of soda; solution of chloride of barium produces (in a fluidounce?) not above 1.14 grain of sulphate of baryta; colour not altered by sulphuretted-hydrogen.

ACETUM DESTILLATUM. *Distilled vinegar.*

Tests, *Edin.* Density 1005; colourless; unaltered by sulphuretted-hydrogen; one hundred minims neutralize eight grains of carbonate of soda.

Tests, *Lond.* One hundred grains neutralize thirteen of carbonate of soda: entirely vaporizable, &c. as under Acidum aceticum.

Process, *Edin.* Take of vinegar (French by preference) eight parts: distil over with a gentle heat seven parts; dilute the product, if necessary, with distilled water, till the density is 1005.

Process, *Lond.* Take of vinegar a gallon: distil in a glass retort from a sand-bath and into a glass receiver seven pints.

Process, *Dub.* Take of vinegar ten parts. Distil with a gentle heat and in glass vessels, rejecting the first tenth and preserving the next seven-tenths, of which the density is 1005.

For. Names.—*Acidum Aceticum.*—*Fren.* Acide acétique.—*Ital.* Acido acetico.—*Ger.* Essigsäure.—*Dut.* Azijnzuur.

Acidum pyroligneum.—*Fren.* Vinaigre de bois.—*Ital.* Aceto di legno.—*Ger.* Holzessig.

Acetum.—*Fern.* Vinaigre.—*Ital.* Aceto.—*Span.* Vinagre.—*Port.* Vinagre.—*Ger.* Essig.—*Dut.* Azijn.—*Arab.* Khull.—*Pers.* Cirka.—*Hind.* Kadi.—*Sans.* Canchica.

Acetum destillatum.—*Fren.* Vinaigre déstillé.—*Ital.* Aceto stillato.—*Span.* Vinagre destilado.—*Port.* Vinagre distillado.—*Ger.* Destillirter essig.

ACETIC ACID has been known in the form of vinegar from time immemorial; but the pure acid was first obtained by Lowitz in 1793. It exists naturally in the form of salts in the juices of many plants, and is produced from vegetable substances both by fermentation and destructive distillation.

It has been admitted into the Edinburgh Pharmacopœia under no less than five forms,—Pure acetic acid, the Pyroligneous acid of the shops, French vinegar, British vinegar, and Distilled vinegar. All these forms are specified, because they are all familiarly used by the druggist. The London College does not distinguish foreign from home-made vinegar; and the Dublin College admits only the former variety, which is surely a mistake. Neither of these colleges recognises expressly the pyroligneous acid of commerce, though in universal use. And the London College does not admit the pure acetic acid; but incorrectly applies the name to a weak acid about the density of 1050, containing not much above a third of its weight of the pure acid of the Edinburgh Pharmacopœia.

1. ACETIC ACID is easily known from all other acids by its peculiar odour and extreme pungency. As commonly sold in the shops it is prepared by the manufacturers of pyroligneous acid. But this kind is never absolutely pure, having usually, according to my own observations, a density of 1068.4, and being of such strength that one hundred minims neutralize only 216 grains of crystallized carbonate of soda. Acid of this strength, however, is quite concentrated enough for all medical purposes. The Edinburgh College has therefore acted wisely in acknowledging the somewhat irregular commercial article. At the same time it has given a process, by which a perfectly pure acetic acid may be obtained of the density 1063. The Dublin Pharmacopœia, like that of Edinburgh, contains this form of acetic acid, but somewhat weaker.

Chemical History.—Acetic acid may be got in various ways, such as by distilling crystallized acetate of copper, by decomposing the binacetate of potash with heat, by heating together sulphate of copper and acetate of lead, by exposing the vapour of alcohol to the action of air and spongy platinum, or by decomposing with sulphuric acid and heat the acetate of lead, lime, soda, or potash. In any of these ways a very strong acid may be obtained. But it is difficult by any of them, and by some impossible, to procure an acid perfectly pure,—that is, without either too much water, or some acetic ether or acetone. One of the easiest methods of insuring purity is to decompose the anhydrous acetate of lead by sulphuric acid at a regulated temperature. The chief difficulty lies in depriving the salt entirely of its water of crystallization. The most convenient way of accomplishing this quickly consists in first heating the salt in a bath of oil or fusible metal at a temperature not exceeding 340° until the fused mass becomes again solid, and then pulverizing it and heating it again as before, but with constant

stirring, until the powder ceases to show any tendency to cohere. From this anhydrous acetate the acid may be separated in a state of extreme purity by adding the salt to the proper atomic proportion of concentrated sulphuric acid contained in a glass-vessel, and then distilling from a fusible-metal bath at a temperature gradually rising towards 340°, but never exceeding it. A stronger heat is apt to darken the matter in the retort; in which case acetone and other pyrogenous compounds are formed. The distilled fluid always carries along with it some fine powder of sulphate of lead and commonly a trace of sulphurous acid. The latter is removed by cautiously adding a minute quantity of the red oxide of lead; by which the sulphurous acid is thrown down in the form of sulphate of lead, being peroxidated at the expense of the oxide. The sulphate of lead is then removed by subsidence or the filter, but more satisfactorily by a second distillation.—The process here explained has been adopted by the Edinburgh College. It has been objected to by Mr Philips as troublesome and unproductive. I can only say that in my own hands and those of various assistants it has proved the very reverse; and I understand it has been adopted on the large scale by an English manufacturer.—An ingenious and simple process has been recently founded on the alternate formation and decomposition of the binacetate of potash. The neutral acetate of potash is distilled with an excess of watery acetic acid. A very weak acid first passes over, until there is left a binacetate with one equivalent of combined water. On then raising the heat to about 390°, and increasing it gradually, but not above 570°, one of the equivalents of acetic acid in the salt distils over in a pure concentrated state; and the operation may be repeated indefinitely on adding more watery acetic acid to the residuum (Melsens).—The Dublin process, which consists in decomposing the acetate of potash by sulphuric acid, is a convenient one. But as this acetate contains combined water, the acid it yields is weaker than that obtained from the anhydrous acetate of lead; and besides, the process is objectionable inasmuch as an expensive salt is employed.—The process for the weaker London acetic acid will be noticed under the head of pyroligneous acid, of which it is really a variety. The salt used in that process, the acetate of soda, is preferable to all other acetates in point of cheapness. But it is not so easily reducible as the acetate of lead to the anhydrous state without escape of acid or charring of the residual salt; and therefore it is not so convenient for making the pure acid. The best way of using it however for this purpose is said to be by heating together ten parts of anhydrous acetate of soda, five parts of coarsely powdered anhydrous sulphate of soda, and twenty parts of concentrated sulphuric acid (Duflos).

Acetic acid, prepared by the Edinburgh formula, is a colourless, mobile fluid, of extreme pungency, very caustic, volatile, vaporizable about 260°, combustible, and crystallizable at 50°, whence it is some-

times called Glacial vinegar. It dissolves copper, lead, and some other metals, with the aid of the action of atmospheric air. It neutralizes many metallic oxides, forming crystallizable salts; and it readily dissolves and neutralizes the vegetable alkaloids. It likewise dissolves resins, volatile oils, and camphor, and consequently is used for the official *Acidum aceticum camphoratum.* It consists of one equivalent, or 51.48, of real acetic acid, and one equivalent, or 9, of water, derived from the sulphuric acid used in the process. The anhydrous acid, which however is not known in the uncombined state, consists of four equivalents of carbon, three of hydrogen, and three of oxygen ($C^4 H^3 O^3 = \bar{A}$). The hydrated acid ($\bar{A}$ + Aq.) contains of course an additional equivalent of hydrogen and oxygen. The density of this when accurately prepared is 1063; but it often reaches 1065, owing to the presence of a little additional water. When of the former density one hundred minims (97 grains) neutralize nearly 242 grains of crystallized carbonate of soda.

An interesting fact first investigated in 1808 by *Mollerat,* is that the density of acetic acid does not always bear an exact relation to its strength. The strength and the density go on increasing in a pretty uniform ratio till the latter reaches 1077.7; but as the strength increases still farther, the density gradually sinks again to 1063, which is the specific gravity of the strongest acid hitherto known in the free state. This fact must be kept in view when the density is used as a test of strength. Between 1063 and 1077.7 the same density may indicate an acid of two very different degrees of strength, the weaker of which is in fact, at 1063, about half as strong as the stronger; while that of 1077.7 is intermediate,—the neutralizing power of 100 grains of these three acids being about 118, 186, and 250, as determined by the carbonate of soda. The density is a tolerably correct measure of strength up to 1063; and above that point it becomes equally so, on observing whether the addition of a small per-centage of water raises or lowers it.

Two tables have been published to show the relation subsisting between density and strength,—one in 1834 by Van der Toorn in the Reports of the British Association, and another in 1840 by Mohr in Buchner's Repertorium. The former differs essentially in some important particulars from the results first obtained by Mollerat, and confirmed by Berzelius, by Thomson, and by some trials of my own. The table of Mohr, which is founded on express experiments, is probably more correct, and is therefore here annexed. It differs however from all statements previously published, as well as from what I have myself observed, as to the point of highest density, which is nearly 1078.

Proportion of Hydrated Acetic Acid in 100 *parts of acid at various densities.*

Hydr. Acet. Ac. in 100 parts.	Density.	Hydr. Acet. Ac in 100 parts.	Density.	Hydr. Acet. Ac in 100 parts.	Density.	Hydr Acet. Ac in 100 parts.	Density.
100	1063.5	74	1072.0	48	1058	22	1031
99	1065.5	73	1072.0	47	1056	21	1029
98	1067.0	72	1071 0	46	1055	20	1027
97	1068.0	71	1071.0	45	1055	19	1026
96	1069.0	70	1070	44	1054	18	1025
95	1070.0	69	1070	43	1053	17	1024
94	1070.6	68	1070	42	1052	16	1023
93	1070.8	67	1069	41	1051.5	15	1022
92	1071.6	66	1069	40	1051.3	14	1020
91	1072.1	65	1068	39	1050	13	1018
90	1073.0	64	1068	38	1049	12	1017
89	1073.0	63	1068	37	1048	11	1016
88	1073.0	62	1067	36	1047	10	1015
87	1073.0	61	1067	35	1046	9	1013
86	1073.0	60	1067	34	1045	8	1012
85	1073.0	59	1066	33	1044	7	1010.7
84	1073.0	58	1066	32	1042.4	6	1008.5
83	1073 0	57	1065	31	1041	5	1006
82	1073.0	56	1064	30	1040	4	1005
81	1073.2	55	1064	29	1039	3	1004
80	1073.5	54	1063	28	1038	2	1002
79	1073.5	53	1063	27	1036	1	1001
78	1073.2	52	1062	26	1035	0	1000
77	1073.2	51	1061	25	1034		
76	1073.0	50	1060	24	1033		
75	1072.0	49	1059	23	1032		

The ordinary acetic acid of the shops differs little in properties from the pure acid just described. It contains 11.2 per cent less acid, and crystallizes at a temperature about 40°; but in other respects its properties are those mentioned above, and it is equally fit for every medicinal and pharmaceutic purpose. The properties of the Dublin acid are also not materially different. Its density is 1074, and consequently it is weaker than the commercial acid; but its corrosive power and pungency are nevertheless great. It is composed of about three equivalents of water, or 27 parts, to one equivalent of real acid, or 51.48.

Adulterations.—Concentrated acetic acid is not much subject to be adulterated. The theory of the instructions of the Edinburgh College for ascertaining its purity is as follows:—A slight variation in density is admitted; but it must not exceed 1068.5, because this is the weakest of the good qualities of commercial acid. The elevation of the density on adding twenty per cent of water shows that the article is the stronger of the two acids which equally possess the density stated in the Pharmacopœia. The addition of this proportion of water raises the density of the commercial acid by 6.5 degrees. The want of action of sulphuretted hydrogen and nitrate of baryta proves the absence of three occasional impregnations, lead, copper, and sulphuric acid. For farther security, the neutra-

lizing power of the commercial acid has been annexed. But this test cannot be accurately applied without much experience; because the red tint given to vegetable blues and purples by acetic acid is faint even when the point of neutralization is somewhat remote.

2. PYROLIGNEOUS ACID, or Pyroligneous acetic acid, is so named because it is prepared by the destructive distillation of wood.

Chemical History.—In this process a dark acid liquor is got in the first instance, called in the shops Pyroligneous vinegar, which has a powerful, smoky odour, and is used by many for imparting a smoky taste to tongues, hams, and the like. The impure acid is purified first by repeated distillation, and then by successively neutralizing it with lime or carbonate of soda, crystallizing the acetate, decomposing this salt by means of sulphuric acid, redistilling the disengaged acetic acid, and repeating these processes until a nearly colourless product is at length obtained. Other means are also used, and each manufacturer is commonly thought to have his own secret for attaining purity.

Pyroligneous acid has usually a very pale straw colour, and a strong acetic odour, scarcely empyreumatic, if the acid be of good quality. It is not, like pure acetic acid, combustible or easily crystallizable. It varies much in density, and therefore in strength. As prepared by the Scotch manufacturers, its density is sometimes so high as 1012; but of late I have commonly found it so low as 1034. Acid of the latter density neutralizes for every hundred minims 53 grains of carbonate of soda, and consequently contains little more than a fifth of its weight of pure acetic acid of the density 1063. In England, again, the manufacturer frequently prepares it of greater strength, the density being nearly 1050. This constitutes the *acidum aceticum* of the London College; by whom it is stated to have a density of 1048 at 62° F. and to be of such strength that 100 grains neutralize 87 of carbonate of soda. The London acetic acid contains only about a third of the concentrated acetic acid of the Edinburgh Pharmacopœia. When common pyroligneous acid of the density 1034 is diluted with three parts of water, it constitutes the Wood-vinegar of the shops.

Adulterations.—The instructions of the Edinburgh College for ascertaining the due degree of purity of pyroligneous acid do not require any explanation beyond what has already been given under the head of the pure acetic acid. Those of the London College bear reference to several adulterations which are seldom practised. The purpose served by crystallizing the salt obtained on neutralizing the acid with carbonate of soda is not apparent. The want of action of acetate of lead proves freedom from sulphuric acid. The non-action of nitrate of silver shows the absence of muriatic acid. Iodide of potassium detects lead by throwing down yellow iodide of lead. Ammonia detects copper by rendering the acid blue when added in excess. Digestion with a silver plate and sub-

sequent testing with muriatic acid constitutes an inelegant mode of detecting nitric acid. The simpler system of tests given by the Edinburgh College is amply sufficient. In fact, adulterations are seldom practised, and the number of them is small.

3. VINEGAR—*Chemical History.*—Vinegar differs from pure acetic and pyroligneous acids in so far as it is much weaker, and contains a variety of foreign admixtures, among which the most important are colouring matter, sulphate of lime, and frequently some spirituous or ethereal substance, whose nature is not precisely known, but which is probably acetic ether. It is this last impregnation which imparts to the better class of vinegars their peculiar grateful aroma. Vinegar is made from many substances,—abroad chiefly from the lighter wines,—in Britain from the different kinds of malt liquor, from malt itself, cyder, sugar, and from the last substance with a certain proportion of raisins, or other materials, the nature of which is kept secret by manufacturers. Vinegar has also been made of late from weak spirit; which is oxidated by exposure over an extensive surface to the action of atmospheric air, under the disposing influence of a little old vinegar, carrot-juice, or other organic substances [Wagemann and Schuzenbach].

The commonly-received theory of the process is that, alcohol being in the first place formed, this substance, which consists of 4 equivalents of carbon, 6 of hydrogen, and 2 of oxygen, is resolved by means of 4 equivalents of oxygen from the atmosphere into 3 equivalents of water (3 HO) and one of acetic acid ($C^4 H^3 O^3$.) Liebig, however, supposes, that in the first instance aldehyd is formed by the combustion of two equivalents of hydrogen ($C^4 H^4 O^2$;) and then, by the absorption of two additional equivalents of oxygen, one equivalent is formed of acetic acid and of water ($C^4 H^3 O^3 + HO$.) The change is effected under the influence of air, a temperature about 80°, and a species of ferment; for the latter of which spongy platinum may be substituted.

Vinegar presents important differences in quality, which must be attended to in Pharmacy. This will appear when it is mentioned, that vinegars differ in strength in the proportion of one to four; that some are so weak as to be incapable of yielding the distilled vinegar of the Pharmacopœias; and that others, on account of their impurities, can scarcely be used at all for making certain pharmaceutic compounds.

The French vinegars imported into this country, which are usually the best qualities prepared in France, are, in comparison with those made in Britain, superior for most domestic and pharmaceutic purposes. This will be shown more particularly under the head of Distilled vinegar. In the present place it may be mentioned, that they are usually stronger, and little subject to adulteration. The vinegar most esteemed in France is the Vinaigre d'Orléans, obtained from the red wines of the Orléannois. The best qualities imported into Britain come from Bordeaux, com-

monly under the name of Champagne vinegar, though made from red wine. Their colour is rather high, and their aroma ethero-acetous. They become of a muddy purple appearance when neutralized by ammonia; and a purplish, fleecy colouring matter slowly subsides. Oxalic acid indicates a trace of lime, nitrate of baryta a trace of sulphuric acid, which is neutralized by bases. The density varies from 1014 to 1022 according to my own trials, but is no correct measure of the strength; which, as will be seen under the head of distilled vinegar, varies exceedingly.

British vinegars are inferior to the French varieties in aroma, commonly paler, often nearly colourless. They contain a trace of lime and of combined sulphuric acid, some of them also a little magnesia and combined phosphoric acid, and others some free sulphuric acid. The last is an express addition, which is permitted to a certain extent by the English excise laws, namely, to the amount of one part in a thousand, but which sometimes exceeds considerably the legal allowance. I have known it to constitute a 250th of the vinegar. Some British vinegars have so disagreeable an aroma as to be wholly unfit for medical use. Their density, so far as I have examined them, fluctuates between 1007 and 1019, but their strength in a less ratio. These facts justify the Edinburgh College in distinguishing two sorts of vinegar, French and British. Some vinegars of this country, it must be observed, come very near the fine qualities of French vinegar in point of aroma; and are distinguishable only by yielding not a purple, but rather a brown precipitate with ammonia. Hence the Dublin College is scarcely justifiable in rejecting home-made vinegar entirely.

Adulterations.—The common adulterations of vinegar in this country are with sulphuric acid, copper, lead, and acrid vegetable substances. The instructions of the Edinburgh College for determining the purity of both kinds are simple. The effect of ammonia in occasioning a purplish muddiness and precipitate in French vinegar distinguishes that variety, so far as I have observed, from all those made in Britain; which are either unaltered by ammonia, or produce with it a dirty brownish precipitate. The addition of a fixed measure of a solution of nitrate of baryta, of fixed strength, sufficient in quantity to throw down all the combined sulphuric acid contained in the finer vinegars, is a simple method of ascertaining any adulteration with the free acid. The operator has merely to remove the precipitate by filtration, and then to ascertain that the liquid is not again precipitated by more of the test. The quantity of the test necessary for complete precipitation in unadulterated vinegar was determined by myself from experiments on twelve different specimens of French and British manufacture. Less is sometimes sufficient; but more is never required. Böttger says so small a quantity as a thousandth of free sulphuric acid may be easily detected by a deposit of sulphate of lime forming, when the vinegar

is boiled with a little chloride of calcium, and allowed to cool; the natural sulphates of vinegar not being thus decomposed.

The instructions of the Edinburgh College for testing British vinegar scarcely require explanation. Sulphuretted-hydrogen will indicate copper or lead, which are both of them, but especially the former, by no means unfrequent impurities. In either case, a black precipitate will be occasioned. The nitrate of baryta used in the same way as for French vinegar proves the absence of an undue proportion of sulphuric acid. It has been objected to this test by Mr R. Phillips, that it excludes many British vinegars, to which under the authority of the Excise laws the maker adds a thousandth of sulphuric acid. But the College has excluded these vinegars intentionally, as being all bad, though sanctioned by the British Excise. Adulterations with acrid vegetables are to be detected by the taste.

The instructions of the London College for the same purpose require little notice. Their method of ascertaining the absence of an undue proportion of sulphuric acid is too tedious and refined for practical use. The instructions of the Edinburgh Pharmacopœia are in this respect superior.

4. Distilled Vinegar. *Chemical History.*—This preparation differs from a weak acetic acid only in containing a variable, though always small, proportion of the ethero-spirituous substance, already mentioned as existing in most vinegars, and which passes over first during distillation. When of good quality, distilled vinegar is quite colourless, of a pure acetous odour, frequently somewhat ethereal, but entirely unmixed with empyreuma or other disagreeable taint. It is not precipitated by any reagent mentioned above, and is wholly evaporated by heat.

The processes of the Colleges for preparing distilled vinegar differ somewhat. The Dublin process rejects the first tenth and then preserves the next seven-tenths. The two other Colleges direct seven-eighths to be distilled, and without rejecting any of the product. The Dublin process is objectionable as not economical. For more than eight-tenths may be drawn off without risk of empyreuma; and though the first tenth is often under the strength required by the College, it is also on the other hand sometimes quite as strong or even more so; while, by taking away seven-eighths, according to the two other Pharmacopœias, and rejecting none of the product, an article is obtained at least as dense as the Dublin standard. The direction to throw away the first portion is also faulty on another account. For it removes the most aromatic part of the fluid, containing probably acetic ether, and consequently injures its qualities for various purposes. Hence probably it is that in numerous trials the distilled vinegar of the Dublin Pharmacopœia has appeared to me more empyreumatized than that of Edinburgh and London from the same material, though in the former case a less proportion is distilled over. Distilled vinegar is occasionally ob-

served to have an empyreumatic odour at first, which passes off on exposure to the air or to considerable cold. The London College has not assigned any density to its distilled vinegar; but the neutralizing standard implies a density about 1007, which is more than all vinegars, and what few British vinegars, are capable of yielding by its formula. The Dublin College states 1005 to be the density of the product obtained by its method; but in point of fact distilled vinegar so prepared is, according to my own observations, seldom so low, and must be diluted,—sometimes with so much as twice its volume of water. The Edinburgh process, therefore, appears the most precise. A density is assumed which every distilled vinegar will reach; and when the product of the distillation is stronger, as often happens, it must be diluted to the standard. The statements now made are illustrated by the following table of experiments.

	Density of the			
	Vinegar.	*First tenth.*	*Next 7-10ths.*	*First 7-8ths.*
1. French Vinegar,	1011.6	991	1006	1005
2. Do.	1022.0	1008	1011	1010.5
3. Do.	...	996	1008	1007
4. Do.?	...	1009.[illegible]	1013	1012.5
5. English, .	1006	1002.7	1006	1005.5
6. Scotch, .	1011	1001.1	1005.5	1004.8
7. Scotch, .	1019	1002.4	1005.5	1005

This table shows; 1. That different distilled vinegars prepared by the same process, without subsequent dilution, differ exceedingly in strength; 2. That the quantity of ethero-spirituous matter, which lowers the density of the first part of the distilled liquor, is still more variable, some samples apparently containing none, but others a large quantity; and 3. That the French vinegars imported into this country are stronger than those of British origin, and yield in general a much stronger distilled vinegar. It may be added, that distilled vinegar from French materials has always a finer aroma than that from British vinegar; whence it has been correctly preferred by the Edinburgh College.—Diluted pyroligneous acid is often substituted in the shops for distilled vinegar, because cheaper;. and in general it answers equally well. But for some purposes it is not so eligible on account of its less agreeable aroma, as for preparing the *Aqua acetatis ammoniæ.* Fifteen parts of the London acetic acid, and eighty-five of water make an acid of equal strength with distilled vinegar (Phillips.)

Adulterations.—The system of tests for ascertaining the requisite purity of distilled vinegar does not differ essentially from that explained already for the stronger acetic acids. The Edinburgh College indicates merely the absence of colour, a density of 1005, a neutralizing power equivalent to eight grains of carbonate of soda for one hundred minims of the vinegar, and the non-action of sulphuretted-hydrogen. These tests will guard against all the adulterations to which distilled vinegar is actually exposed. The London College omits the density, which is an important oversight;

and in addition to the Edinburgh tests has given others referring to impurities with which this preparation is scarcely ever contaminated. It has already been observed that the neutralizing power assigned by the College is too high, at least infers an acid of greater strength than it is generally possible to obtain by the formula.

Actions and uses.—The uses to which the several forms of acetic acid are applied in medicine are numerous. The stronger forms are corrosive, irritant, and therefore poisonous; the weaker are stimulant, tonic, refrigerant, astringent, antiseptic, diaphoretic, and diuretic.

The pure acid is used externally alone. It is a convenient means for quickly producing on the skin redness, vesication, or ulceration, according to the time it is left applied; but it is not much resorted to for these purposes. It is probably the best of all corrosives for destroying warts and corns; which depends on its powerful solvent action over gelatin, albumen, and fibrin. On account of its peculiar pungency and grateful odour, it is an excellent remedy for fainting when held near the nostrils, especially if aromatized. For this purpose the best form is the patent preparation called Henry's aromatic vinegar.

Pyroligneous acid has been supposed by some to possess peculiar medicinal properties; but when sufficiently diluted its actions do not differ from those of common and distilled vinegar. The strong acid of the London Pharmacopœia is said to cure ringworm of the scalp by a single application; and when diluted with three waters it has been used to detect commencing spots of the disease, by reddening them [Dr Wigan]. The London acid being a good solvent of cantharides, it is employed for making a useful blistering liquid, the *Acetum cantharidis*, L. E. On account of its superiority over common vinegar in purity, and distilled vinegar in cheapness, it is now commonly preferred to both by druggists; and it may be correctly employed in a diluted state for making various pharmaceutic preparations familiarly known by the name of vinegars, such as the *Acetum opii*, *colchici*, *scillæ*, and the *Oxymel scillæ*. It is a powerful antiseptic for dead animal and vegetable matter. Diluted with three or four waters, according to its density, it answers well for preserving some vegetable specimens, such as pulpy fruits, bulbs, and fresh leaves. I have thus preserved specimens unchanged for twelve years.

Vinegar is used externally for many purposes. It is employed as a refrigerant for spunging the body in most febrile diseases; in which, however, its advantage over cold water is doubtful. Its vapour inspired with that of hot water from a proper inhaler is of decided service in most varieties of laryngeal inflammation, hoarseness, relaxed sore throat, and ulceration of the fauces, especially if aphthous in its characters. It is a useful constituent of gargles in various forms of sore throat, and of some collyria for ophthalmia.

It farther forms a part of many lotions for external inflammation, ulcers, and chronic eruptions. It is a favourite domestic remedy for fumigating the apartments of those ill of contagious diseases; for which, except in so far as it may inspire confidence, it seems of questionable utility. It has not, like the mineral acids, the property of destroying animal matters, so that infectious effluvia may escape its action unaltered; and besides, its overwhelming odour may render the attendants insensible to the necessity of ventilation. Its current employment in the form of vapour for disinfecting letters and other articles from countries infested with plague, is a relic of ignorance unworthy of the present state of chemical science. Internally vinegar has been at different times employed, in consideration of its actions formerly enumerated, for the treatment of many diseases,—in fevers as a refrigerant, in typhus as an antiseptic, in hectic as a refrigerating astringent, in dropsy as a diuretic, and indeed, it may be added, empirically in most diseases. But in the present time, and in this country at least, it has been almost entirely abandoned as an internal remedy, in favour of more powerful drugs of the same properties. Even its undoubted virtues in the colliquative sweating of hectic have not prevented it from being displaced by the more energetic mineral acids. It is familiarly used in small quantities as a seasoning for promoting the digestion of various kinds of food. But in large quantity it interrupts digestion; and hence it is often used, though very imprudently, by young females for reducing corpulency. It was at one time currently employed as an antidote for all kinds of poisoning; but its applications of this kind are now limited. Vinegar is undoubtedly one of the best remedies that can be employed as an antidote for the alkalies and alkaline carbonates, because it converts them into comparatively inactive salts. But in poisoning with metallic compounds, vegetable narcotics, and many vegetable irritants, where it was once almost invariably used, it does harm for the most part instead of good, because it aids the solution of the active parts of these poisons. In pharmacy it was once much used for making various preparations known under the name of vinegars. But on account of its tendency to spoil, it has properly been abandoned for the purer distilled vinegar or diluted pyroligneous acid.

Distilled vinegar may be used for most of the external purposes to which vinegar itself is applied; and it is commonly preferred for making lotions and eye-washes. It is never given internally on its own account. It is the solvent directed by the pharmacopœias for making the vinegars of opium, squill, and colchicum; and like other forms of acetic acid, is an appropriate solvent of these, equally with many other vegetable drugs whose active ingredient is either an alkaloid or a neutral crystalline principle. In such cases the acid seems to be at times something more than a mere solvent, and modifies the action of the drug. It is held at least to mitigate the

acrimony of squill, and it renders opium less apt to produce unpleasant after effects.

ACIDUM ARSENIOSUM, *L.* See *Arsenicum Album.*

ACIDUM BENZOICUM. *Benzoic Acid.*

TESTS, *Edin.* Colourless: sublimed entirely by heat.
TESTS, *Lon.* A gentle heat disperses it with a peculiar odour. Water dissolves it sparingly, rectified spirit more freely. Solution of potash or of lime dissolves it entirely, and hydrochloric acid throws it down again.

PROCESS, *Edin. Lon.* Take of Benzoïn any convenient quantity (a pound, L.): put it into a glass matrass (a proper vessel, L.): and by means of a gradually increasing heat (from a sandbath, L.): sublime as long as anything rises: squeeze the sublimate between folds of filtering paper to remove the oil as much as possible; and sublime the residuum again.

PROCESS, *Dub.* Take of
Benzoïn five parts;
Fresh burnt lime, and
Muriatic acid, of each one part.
Water two hundred parts.

Triturate the benzoïn with the lime; boil them for half an hour in 130 parts of water, with constant stirring; let the vessel rest, and pour off the liquor when cold. Boil the residue with the rest of the water, and pour off the cold liquor. Evaporate the liquors to one half, filter through paper, and add the acid gradually to the cold fluid. Pour away the liquid, wash the powder with a little cold water, dry it with a gentle heat, and sublime benzoic acid from it in a proper vessel with a gentle heat.

FOR. NAMES.—*Fr.* Acide benzoique.—*Ital.* Acido benzoïco.—*Ger.* Benzoesäure. *Dut.* Benzoin-zuur.

BENZOIC ACID seems to have been known so early as the fifteenth century; but the process for obtaining it was first described by Blaise de Vigenère in the beginning of the subsequent century. It exists in various balsamic substances, such as benzoïn, storax, and tolu balsam, in the vanilla-pod and tonka-bean, and in the urine of children and some herbivorous animals under peculiar states of decomposition.

Chemical History.—It is obtained from benzoïn either by sublimation,—or by decomposing a benzoate formed by the solvent action of an alkaline solution,—or by crystallizing it from an alcoholic solution of benzoïn, which is first deprived of resin by dilution with water, and then of its alcohol by distillation,—or by the decomposition of benzoïc ether. The first method, which is adopted by the London and Edinburgh Colleges, yields the largest quantity; and though the product is contaminated with empyreumatized oil, this is probably no disadvantage for medicinal purposes. The best mode of applying the process is to support a flat iron plate covered with sand over a charcoal fire, and to place on the sand a shallow flat iron basin, upon which the benzoïn is strewed uniformly in coarse powder; to the edge of this basin is fitted a moveable ring, like a lid, to which a diaphragm of white bibulous paper is attached by paste: and the whole is covered with a close cylinder of thick paper of the form of a man's hat. On applying a gentle heat for three or four hours, and lifting off the bibulous paper from time to time by means of the ring, to stir the benzoin, the acid is sublimed through the paper, in which the empyreumatized oil is

retained (Mohr). An acid chemically pure is better prepared by some such process as that of the Dublin College, which consists in forming a watery solution of benzoate of lime, precipitating the benzoic acid by muriatic acid, and subliming the precipitate. The newest process is that of Wöhler, who dissolves benzoïn in rectified spirit, adds hydrochloric acid, and distils over benzoïc ether, which is decomposed by potash; and the benzoate of potash is then decomposed by hydrochloric acid. Good benzoïn yields from 12 to 16 per cent of acid.

This acid is usually sold in the form of white pearly scales, which are flexible, of an acrid, feebly acid taste, and of a peculiar balsamic odour, perceptible even when prepared by Wöhler's method. It is fusible, somewhat volatile at atmospheric temperatures, easily vaporizable, inflammable, soluble in twenty-four parts of boiling water and in two hundred parts at 60° F., more soluble in alcohol, and considerably so in acetic acid. It is composed of fourteen equivalents of carbon, five of hydrogen and three of oxygen ($C^{14} H^5 O^3$), and its crystals contain also an equivalent of water. Its radical is a crystalline compound called Benzoïl, which contains one equivalent less of oxygen ($C^{14} H^5 O^2$), and which forms a variety of interesting compounds with other elements and compound radicals.

Action and Uses.—Benzoïc acid is somewhat irritant, especially in the form of vapour. When swallowed it passes off by the urine in the form of hippuric acid. It was therefore lately proposed as an antilithic in lithic gravel. But experience has not confirmed the hopes entertained of it as such. It has been long held, along with the balsams which contain it, to possess important specific virtues in chronic pulmonary diseases, and particularly in chronic catarrh. Its utility has been greatly overrated in this respect, and is now altogether distrusted. It might indeed be expunged from the pharmacopœias, were it not that long usage has sanctioned it as a part of two very useful preparations, the *Tinctura opii camphorata*, E. D. or *camphoræ composita*, L. and the *Tinctura opii ammoniata*, E.

ACIDUM CITRICUM. *Citric Acid.*

Tests, *Edin.* A solution in four parts of water is not precipitated by carbonate of potash: when incinerated with the red oxide of mercury no ash is left, or a mere trace.

Tests, *Lond.* Soluble . the precipitate thrown down in its solution, after saturation with sesquicarbonate of ammonia, by acetate of lead or muriate of baryta is soluble in diluted nitric acid: not precipitated by any salt of potash except the tartrate: entirely dissipated by heat.

Process, *Edin.* Take of
Lemon-juice, four pints;
Prepared chalk, four ounces and a-half, or a sufficiency.
Diluted sulphuric acid, thirty-six fluid-ounces, or in the same proportion to the chalk required.

Boil the lemon-juice, let it rest, pour off the clear liquor, boil this again, and add the chalk to it while hot by degrees till there is no more effervescence, and the liquid ceases to taste acid. Collect the precipitate, and wash it with hot water till the water passes colourless. Squeeze

the residuum in a powerful press; mix it uniformly with two pints of distilled water; and then add the sulphuric acid by degrees, and with constant stirring. Try whether a small portion of the liquid, when filtered, gives with solution of nitrate of baryta a precipitate almost entirely soluble in nitric acid; and if the precipitate is not nearly all soluble, add a little citrate of lime to the whole liquor till it stand this test. Separate now the clear liquor by subsidence or filtration, washing the insoluble matter with cold water, and adding the washings to the liquor: concentrate with a gentle heat till crystals form on the surface: set the liquor aside to cool and crystallize, and purify the crystals by repeated solution and crystallization till they are colourless.

PROCESS, *Lond. Dub.* Take of
Lemon-juice, 4 pints (any quantity, D.;)
Prepared chalk, four ounces and a-half (what is necessary, D.;)
Diluted sulphuric acid, twenty-seven fl. ounces and a-half (eight times the weight of the chalk used, D.;)
Distilled water, eight pints.
Boil the juice, add the chalk gradually, mix, after subsidence pour off the supernatant liquor, and wash the citrate of lime frequently with tepid water (and dry it, D.) Add the acid previously diluted with the water, boil for fifteen minutes, squeeze strongly through a cloth, filter, concentrate with a gentle heat, and set the liquid aside to crystallize. Purify the crystals by twice successively dissolving, filtering, concentrating, and crystallizing.

FOR. NAMES.—*Fr.* Acide citrique —*Ital.* Acido citrico.—*Ger.* Citronensäure.—*Dut.* Citroenzuur.

CITRIC ACID was discovered by Scheele in 1784. It is contained in the juice of a considerable number of fruits, such as the pulp of tamarinds, unripe grapes, the cherries of the Prunus padus, the cran-berry, the whortle-berry, the bitter-sweet-berry; but it abounds most of all in the fruit of the genus *Citrus*, and especially of two species, the lemon and lime.

Chemical History.—All the citric acid used in this country is obtained from the lemon, and is prepared on the large scale chiefly for the calico-printer. The process consists in forming an insoluble citrate of lime by neutralizing the juice with chalk, and decomposing this citrate by sulphuric acid, which unites with the lime to produce an insoluble sulphate of lime, while the disengaged citric acid is subsequently obtained in the solid form by concentrating its solution and crystallizing it. The process is one of considerable nicety, and cannot be successfully performed without attention to several minute details, most of which are stated in the Edinburgh formula. It has been found of service for the subsequent purification of the acid to commence by clarifying the juice with albumen. The filtered fluid being then heated to the boiling point, finely levigated chalk is gradually stirred into it till the juice ceases to taste acid. It is impossible to fix the correct proportion of chalk, because the juice varies much in its degree of acidity. When the citrate of lime has been well freed of adhering juice by repeated washing with warm water, it is decomposed by diluted sulphuric acid in the proportion of nine parts of the concentrated acid for every ten parts of chalk used. The acid must be added by degrees, in the diluted state, and with constant careful stirring to prevent the citrate from caking. The whole is then boiled for a few minutes, and the action allowed to go on for some days; after which care is taken that there is no excess either of sulphuric acid

or of citrate of lime; and any excess is corrected by supplying more citrate or more acid respectively. The liquor is now separated partly by subsidence, partly by filtration, and the precipitate is well washed with cold water. The liquor and washings being next concentrated to the density 1130, the product is removed into shallow vessels and evaporated until a pellicle begins to form; at which point the process must be immediately stopped to prevent charring. Several days of rest are required for complete crystallization. The mother-liquor, which has a very dark colour, is treated anew like the original juice. The crystals are purified by two successive solutions and crystallizations, in the course of which various contrivances are followed to secure thorough purity. According to Berzelius the best plan is to boil the solution in the last step with a little nitric acid. One hundred and sixty ounces of good lemon-juice yield from four to six ounces of pure acid (Wood and Bache), according to some so much as ten ounces (Duncan.)

Citric acid readily crystallizes by spontaneous evaporation in right rhombic prisms terminated by four planes. It also crystallizes, but more confusedly, by cooling a hot solution. It has an intense acid taste, and is permanent in the air. It is soluble in less than its own weight of temperate, and half its weight of boiling, water. The solution spoils by keeping. It is also soluble in alcohol and in ether. It fuses in its water of crystallization; and at a higher heat it is decomposed, giving off a new acid of different properties which is named pyrocitric acid. Being always sold in large crystals, it is easily distinguished by its external characters from every vegetable acid except the tartaric; and from this it is distinguished by not giving a crystalline precipitate when its solution is treated with muriate of potash; for the citrate of potash is a very soluble, deliquescent salt, while tartaric acid forms a sparingly soluble bitartrate. The salts of lime, baryta, lead and silver cause white precipitates in its solutions. Different views have been taken of the composition of citric acid. According to the older opinions the radical acid is represented by the formula $C^4 H^2 O^4$; and in the crystals obtained by cooling a hot solution this is combined with one equivalent of water of crystallization; while in those obtained by spontaneous evaporation three equivalents of radical acid are united with four of water. But according to the more recent views of Liebig, citric acid is a tribasic acid, the radical of which is $C^{12} H^5 O^{11}$; and both crystals consist of this radical together with three equivalents of combined water, but united in the former with one equivalent, and in the latter with two equivalents, of water of crystallization.

Adulterations.—It is subject to be adulterated with lime; and tartaric acid is often sold as citric acid. The presence of lime is indicated by the process of incineration as mentioned by both the British colleges; and this process is facilitated by mixing the char-

red mass with red oxide of mercury, as the Edinburgh Pharmacopœia directs. Tartaric acid, if present either as a substitution or adulteration, is indicated by a crystalline bitartrate being deposited by carbonate of potash in a strong solution containing about one part of acid in four of water. Other tests given by the London College are unnecessary in reference to the usual condition of the citric acid of the shops. If the precipitate caused in its solution by acetate of lead or muriate of baryta is not entirely soluble in nitric acid there is sulphuric acid present. The tartrate of potass causes a precipitate in its solution, because, the citric acid attaching to itself a portion of the base, the comparatively insoluble bitartrate of potash is formed; but this property is no evidence of its not being adulterated.

Action and Uses.—Citric acid is a refrigerant and tonic, like most other acids. It may be used for compounding acid drinks, for imitating lemonade, and for preparing effervescing powders. But it is never used for any of these purposes, because the cheaper tartaric acid serves equally well. The citrated kali, citra[illegible] effervescing powders, and lemonade powder, of the shops, never contain any other than the tartaric acid. The truth is, that citric acid might without injury be expunged from the Pharmacopœias; because for every medicinal purpose tartaric acid is quite as convenient, and it is not above a third of the price. There might be an objection indeed to the expulsion of citric acid, if it possessed the peculiar antiscorbutic virtues of the juice from which it is obtained: but this is generally disbelieved. Precise facts however are still required upon the subject.

The dose of citric acid varies from twenty grains to a drachm. For effervescing powders thirty grains may be used, and the equivalent quantities of the alkaline salts are fifty grains of bicarbonate of potash, forty-two sesquicarbonate of soda, or thirty sesquicarbonate of ammonia.

ACIDUM HYDROCHLORICUM, *L.* See *Acidum Muriaticum.*

ACIDUM HYDROCYANICUM, *E.* ACIDUM HYDROCYANICUM DILUTUM, *L.* ACIDUM PRUSSICUM, *D.* *Hydrocyanic acid, diluted with about thirty (fifty, L.) parts of water. (Medicinal) Hydrocyanic acid.*

TESTS, *Edin.* Solution of nitrate of baryta causes no precipitate: 50 minims, diluted with one fluidounce of distilled water, agitated with 390 minims of solution of nitrate of silver, and allowed to settle, precipitate with 40 minims more of the test; but a farther addition of the test after agitation and rest has no effect: The precipitate entirely disappears in boiling nitric acid.

TESTS, *Lond.* Colourless; entirely vaporizable, with a peculiar odour; slightly and transiently reddens litmus; unaffected by sulphuretted hydrogen; one hundred grains give with solution of nitrate of silver ten grains of precipitated cyanide of silver, easily soluble in boiling nitric acid; the presence of any other acid is indicated by the iodo-cyanide of mercury and potassium being reddened; 100 grains contain two of pure acid, to which strength it must be reduced, howsoever prepared.

PROCESS, *Edin.* Take of
Ferrocyanide of Potassium, 3 ounces,
Sulphuric acid, two fluidounces,
Water, sixteen fluidounces.

Dissolve the salt in eleven fluidounces of the water, and put the solution into a mattrass with a little sand: add the acid, previously diluted with five fluidounces of the water and cooled: connect the mattrass with a refrigeratory: distil with a gentle heat, by means of a sandbath, or naked gas-flame, till fourteen fluidounces pass over, or till the residuum begins to froth up. Dilute the product with distilled water till it measures sixteen fluidounces.

PROCESS, *Lond.* Take of
Ferrocyanide of potassium, two ounces,
Sulphuric acid, one ounce and a-half,
Distilled water, a pint and a-half.

Dilute the acid with four fluidounces of water in a glass retort, and when cooled add the salt previously dissolved in half a pint of water. Put eight fluidounces of water into a receiver, adapt the retort, and with a gentle sandbath heat distil six fluidounces. Dilute the product with six fluidounces more, or so that 100 grains shall exactly saturate 12.7 grains of nitrate of silver dissolved in distilled water.—Diluted hydrocyanic acid may also be prepared, where it is to be more quickly used, by agitating in a close phial nine grains and a-half of cyanide of silver, nine minims of diluted hydrochloric acid and one fluidounce of distilled water, and then pouring off the clear liquid after a short interval.—This acid ought to be kept excluded from light.

PROCESS, *Dub.* Take of
Cyanide of mercury, one ounce,
Muriatic acid, seven fluidrachms.
Water, eight fluidounces.

Distil eight fluidounces from a retort into a cooled receiver. Preserve the product in a well-closed phial in a cold and dark place. Its density is 998.

FOR. NAMES.—*Fr.* Acide hydrocyanique.—*Ital.* Acido idrocianico.—*Ger.* Blausäure.—*Russ.* Sinilnaia kislota.

HYDROCYANIC ACID [Prussic acid, Cyanhydric acid] was discovered in its diluted state by Scheele in 1782, and was first obtained in a state of purity by Gay-Lussac. It has been long used in medicine in its natural state of combination with certain essential oils derived from the Drupaceous family of vegetables. But the acid as obtained separately was little employed till it was recommended by Magendie in 1817. It exists in the distilled waters of the bitter-almond, and seeds of other drupaceous plants, in the distilled waters of pomaceous seeds, in the expressed juices of the leaves of the cherry-laurel, peach, and bird-cherry, and in the juices or distilled waters of some other vegetables. But the chief source from which it is primarily obtained for medical and chemical use is animal matter subjected to heat in contact with alkaline substances.

Chemical History.—A difference of opinion prevails respecting the most eligible process for obtaining medicinal hydrocyanic acid. The reason is that the numerous processes which have been proposed differ much in cheapness and facility, in the uniformity of the product, in its freedom from impurity, and in the length of time it may be preserved. Those which have attracted most attention are the following: the decomposition of bicyanide of mercury by sulphuretted hydrogen,—the decomposition of the same salt by muriatic acid,—the decomposition of cyanide of potassium by tartaric acid,—and the decomposition of ferrocyanide of potassium by sulphuric acid. 1. When bicyanide of mercury in solution is subjected to a stream of sulphuretted-hydrogen, the black sulphuret of mercury falls down, and the disengaged cyanogen and hydrogen at the same time unite to form hydrocyanic acid. If the filtered fluid be deprived of the excess of sulphuretted-hydro-

gen, by a little carbonate of lead, a very pure acid is obtained. This process, which has been usually called the process of Vauquelin, is objectionable, because an expensive salt is used, and because the acid produced is very apt to decompose.——2. When bicyanide of mercury is heated with diluted muriatic acid, water is decomposed and oxide of mercury formed, which unites with the muriatic acid to constitute hydrochlorate of peroxide of mercury; while hydrocyanic acid, formed by the disengaged cyanogen and hydrogen of the water, distils over along with watery vapour. By this process too a pure acid may be obtained, but not so uniform in strength as the former unless extreme care be taken in regulating the distillation. It is, like the previous process, an expensive one, and the acid, if quite pure, is also apt to decompose; but in point of fact, it commonly keeps better, probably because in that case it contains a little muriatic acid. This method, usually called the process of Gay-Lussac, has been preferred by the Dublin College.——3. The method by decomposing cyanide of potassium with tartaric acid, first suggested by Dr Clarke, although ingenious, is now abandoned as being too precarious for ordinary use. ——4. The method most generally practised consists in decomposing the ferrocyanide of potassium by diluted sulphuric acid. The chemical actions here are somewhat complex, and perhaps not yet well understood. The most recent view, founded on the atomic constitution of the ferrocyanide of potassium and the nature of the residuum in the mattrass, is as follows. The ferrocyanide, at present usually considered a compound of one equivalent of cyanide of iron and two of cyanide of potassium, with three of water, must accordingly contain one equivalent of iron, three of cyanogen, two of potassium and three of water; and two equivalents therefore contain two of iron, six cyanogen, four potassium, and six water. When decomposed by sulphuric acid, three equivalents of potassium unite with the oxygen of three equivalents of water to form three of potash, which combine with sulphuric acid. Three equivalents of cyanogen, at the same time disengaged along with three of hydrogen, unite to form three of hydrocyanic acid. There remain in the mattrass, besides a sulphate of potash, two equivalents of iron, three of cyanogen and one of potassium, forming a yellow salt, a new compound of these bodies. This explanation, derived from the investigations of Mr Everitt, applies where sulphuric acid is used in the proportion of six equivalents, that is, in such quantity as to constitute bisulphate of potash with the three equivalents of potash which are generated. The process now explained has the advantage of being cheaper than all, and easier than most others; and it furnishes an acid of great purity, not liable to decomposition even under exposure to diffuse light. The strength of the acid is indeed somewhat variable, as must be the case with every process implying distillation; but if the refrigeratory described in the introduction be used, the variation is too slight

to signify in medical practice. The proportions in the Edinburgh formula ought to yield according to Mr Everitt's theory 245 grains of pure hydrocyanic acid, or about 16·8 fluidounces of medicinal acid containing a thirtieth of pure acid. The formula directs 16 fluidounces to be obtained; and I have repeatedly found that amount to possess the required strength. The formula therefore is a close approximation to theoretical accuracy. In applying it the ebullition should be kept gentle at first, as the largest proportion of acid vapour passes over in that stage. A retort is less convenient than a mattrass, because the material is apt to be spurted up or to creep over into the neck of the retort. With the refrigeratory alluded to above water of ordinary temperature is sufficient for condensing the vapours even in summer; but if a retort and common receiver be employed, it is necessary to cool the receiver with ice at all seasons. There is no advantage in putting a portion of the water for dilution in the receiver, as recommended by the London College. The proportion of sulphuric acid recommended by the Colleges exceeds what is sufficient to produce bisulphate of potash in the residuum. A large excess is said to cause farther decompositions, and, among other changes, the production of formic acid. The minutiæ of this method have been carefully examined by Thaulow; who found that the proportion of sulphuric acid does not signify, provided it amount to at least three-fourths of an equivalent for every equivalent of cyanide of potassium in the ferro-cyanide; that three-fourths only of the cyanogen in the cyanide of potassium are converted into hydrocyanic acid; that this quantity is constantly obtained, if the distillation be conducted quickly; and that if the distillation be slow, cyanide of ammonium is formed, which is the cause of the distilled liquor sometimes undergoing spontaneous decomposition.

These are not the only processes by which a diluted hydrocyanic acid may be obtained; but they are the most eligible of the methods yet proposed. The London College, in addition to that just described, has introduced, as an alternative for extempore use, a new process first proposed by Mr Everitt, which consists in the decomposition of the cyanide of silver by muriatic acid. If this salt be agitated in water with its equivalent of muriatic acid mutual decomposition ensues, hydrocyanic acid is found in the water, and chloride of silver falls down and may be separated by subsidence or filtration. A pure uniform acid may be thus made; but the process is costly. The College through oversight directs a fluidounce of water to be used for every 9½ grains of cyanide. The quantity ought to be 95 grains.

In a state of perfect purity, free of water, hydrocyanic acid is most easily obtained by passing sulphuretted-hydrogen gas first through fragments of chloride of calcium to dry it thoroughly, —and then through a tube which is filled with powdered bicyanide of mercury, and terminates in a bottle kept cold by a

mixture of ice and salt. The gas and salt undergo mutual decomposition, a black sulphuret of mercury is formed in the tube, and pure hydrocyanic acid vapour passes over and condenses in the bottle, or remains partly in the tube, whence it may be propelled by gentle heat.

Hydrocyanic acid in a state of purity is colourless, and of a highly diffusive, peculiar odour, incorrectly likened by many to the smell of bitter-almond oil or cherry-laurel water. Its density is ·706, its boiling point 80° F., and it produces cold enough while evaporating to occasion its own solidification. At ordinary temperatures it quickly undergoes decomposition, acquiring a black colour, and becoming at length a grayish-black solid ammoniacal substance, the black portion of which is paracyanogen. At 32° I have kept it unaltered for three weeks; so that probably it may be thus preserved for an indefinite period. Although properly considered an acid, it feebly reddens vegetable colours, and it does not neutralise the alkaline reaction of the bases with which it unites. It is composed of one equivalent each of cyanogen and hydrogen, that is of one equivalent of nitrogen, two of carbon, and one of hydrogen, or 14·5 nitrogen, 12·24 carbon, and 1 hydrogen (NC^2H or CyH). It unites with water and alcohol.

The diluted or Medicinal acid is colourless, like the pure acid, and possesses the same peculiar, penetrating, diffusive odour. This odour is a characteristic and delicate test. But care must be taken not to confound it with the odour of bitter-almond oil, as many do; for that odour is decidedly different, and depends much more on a true essential oil than upon the concomitant hydrocyanic acid. A fully better test than its odour is the action of sulphate of iron. If a few drops of caustic potash be added to the fluid containing hydrocyanic acid, and then a solution containing the two sulphates of the sesquioxide and protoxide of iron, a dirty blue or greenish-blue precipitate forms, which becomes bright Prussian blue on the addition of a little sulphuric acid to redissolve the intermingled oxide of iron. Another useful test is the solution of nitrate of silver, which throws down a white cyanide of silver, distinguishable from other white insoluble salts of that metal by being insoluble in nitric acid in the cold, but disappearing under ebullition. In the latter case something more than mere solution is accomplished, the silver being oxidated and dissolved by the nitric acid, while the cyanogen passes off in the form of hydrocyanic acid vapour.

The diluted acid is more easily preserved than that which is pure. A great difference however prevails in this respect according to the process by which it has been prepared. Specimens prepared from bicyanide of mercury, especially by sulphuretted-hydrogen, have appeared to me the most prone to decomposition: Even in a dark place they sometimes begin to blacken within twenty-four hours. Those again prepared by the action of sulphuric acid on ferro-

cyanide of potassium I have invariably found to keep remarkably well. A specimen of medicinal strength continues still colourless, though it has been exposed to diffuse light for thirteen years; and I once kept for thirteen months unaltered a specimen which contained forty per cent of real acid. It has appeared to me, as it has also done to others, that those diluted acids keep best which contain a trace of some mineral acid; and in most of the specimens just referred to a trace of sulphuric acid was present. But at the same time I have known medicinal hydrocyanic acid from ferrocyanide of potassium keep perfectly well, although nitrate of baryta did not produce in it the slightest muddiness. Those which contain cyanide of ammonium are very prone to decomposition, but the addition of a trace of sulphuric acid renders them permanent [Thaulow]. The change is accelerated by exposure to light, especially to the direct rays of the sun. It is scarcely necessary to mention, that, on account of the volatility of this acid, it must always be kept in well-closed phials, otherwise its strength quickly diminishes: Glass stoppers however are not absolutely necessary for its preservation, as many suppose.

Adulterations and their Tests.—The medicinal hydrocyanic acid of the shops frequently contains impurities; and it is exceedingly apt to vary in point of strength. On these accounts great care has been taken by the Edinburgh and London colleges to guard the practitioner and druggist against its irregularity and adulterations. The ordinary impurities are sulphuric or muriatic acid, derived from these acids having been allowed to pass over in the process of distillation; and sometimes, when hydrocyanic acid is prepared by decomposing bicyanide of mercury with sulphuretted-hydrogen, there is a trace of that salt in consequence of the gas not having been supplied in excess. The presence of either acid is shown by the precipitate with nitrate of silver being not entirely dissolved by boiling nitric acid; or, as the London College indicates, by a red precipitate of biniodide of mercury being produced by the double salt of iodide of potassium and bicyanide of mercury (Geoghegan.) In regard to these impurities, however, it must be remarked, that a trace of some inorganic acid is not objectionable, as it prevents the hydrocyanic acid from undergoing decomposition. The presence of bicyanide of mercury is proved, according to the London directions, by the action of sulphuretted-hydrogen on the mercury; but the test is unnecessary as this salt is almost abandoned now for making medicinal acid. The effects of heat on the acid and of the acid upon litmus, which have been added by the London College to the tests of its purity, are likewise superfluous.—A more important subject than the adulteration of hydrocyanic acid is its irregular strength. At one time the acid in the shops of London and Edinburgh varied in strength in the ratio of one to four; and even still the variation is considerable. A great deal has been written on this head, and numerous attempts have been made to render

the medicinal acid uniform in strength. These researches have been undertaken under the erroneous notion, that extreme uniformity is practically attainable, as well as practically necessary.* But I apprehend, that every process for hydrocyanic acid presents more or less the elements of irregularity, which scarcely any care can altogether avoid; and that irregularity within certain limits may exist without the slightest danger or inconvenience in medical practice. It is of more consequence therefore to fix the limits within which the acid may allowably vary, and within which the manufacturer may easily confine himself, than to strain after absolute uniformity. An authoritative standard of tests requiring anything like perfect uniformity, would exclude nine-tenths of what is prevalently met with in the shops even of careful tradesmen, and which is quite fit for medicinal use. It is impossible then to assent to the condition imposed by the London formula, that "one hundred grains of medicinal hydrocyanic acid shall yield with nitrate of silver ten grains of precipitate,"—shall "exactly saturate 12.7 grains of nitrate of silver." In the first instance, the test is much too tedious and difficult for ordinary use, at all events in the former shape. But, which is of more consequence, few specimens of well-prepared acid would stand so rigorous a test; and much less would they continue to do so after being put a little to use in the establishment of a druggist. A superior plan both in principle and in detail is that adopted by the Edinburgh College. A variation of an eleventh part in point of strength is allowed; and an easy method is given for ascertaining that the variation is not greater in either direction. The method is to be thus applied. Fifty minims being diluted with distilled water, 390 minims are added of a solution containing a fortieth of nitrate of silver, and the whole is briskly agitated; upon which the cyanide of silver instantly subsides. As a small quantity of acid should still remain, forty additional minims of the solution will occasion a farther precipitate with the clear supernatant liquid, if the preparation be not too weak; but on again obtaining a clear fluid by agitation and a few seconds of rest, the subsequent addition of the nitrate of silver will no longer have any effect, unless the acid be too strong. In practice nothing can be easier than this method of examination; and I have always found that it gave the expected results with hydrocyanic acid prepared according to the Edinburgh formula.—— Other methods have been proposed for ascertaining the strength of hydrocyanic acid. The best of these is its degree of solvent power over red oxide of mercury; but the method by nitrate of silver is more convenient. The density, which is the only criterion admitted by the Dublin College, is much too coarse a test as applied in ordinary practice.—It is a matter of regret in regard to a drug of so great energy as this, that the whole British Colleges have not adopted the same strength for their standard. The Dublin College, which first in this country admitted hydrocyanic acid

into the Materia Medica, correctly assumed it of the strength most in use at the time the Dublin Pharmacopœia was published, that is about 3.3 per cent, or what is usually called Vauquelin's acid. The Edinburgh College adopts the same proportion, with a small allowance for unavoidable variations. The London College, which might also have followed the example of Dublin without inconvenience, has reduced the percentage to two parts only.

Action and Uses.—Hydrocyanic acid has been admitted into medical practice chiefly as a calmative, anodyne and antispasmodic. It is well known to be a very powerful narcotic poison, the most powerful perhaps which modern chemistry has hitherto disclosed. It induces coma and convulsions, especially of the muscles of respiration, constituting phenomena not unlike those which characterize some varieties of the epileptic paroxysm. Death commonly ensues in the human subject within five minutes; but sometimes it is delayed for three-quarters of an hour; and on the other hand there can be no doubt from repeated observation on the lower animals, that it might be induced by large doses, especially of the pure acid, in the course of a very few seconds. Death has been occasioned in man by a mixture containing scarcely one grain of the pure hydrocyanic acid. Congestion of the brain is commonly found after death, more rarely exhaustion of muscular irritability; and in every instance of rapid death the poison may be found in the stomach for some days afterwards. For a poison so speedy in its operation scarcely any antidote can be practically available. The best however is the administration of carbonate of potash followed by the mixed sulphates of iron, to convert the poison into Prussian blue [Messrs Smith]. The proportions are 144 grains of carbonate of potash in two ounces of water, and a similar solution of a drachm of sulphate of protoxide of iron with two drachms of the same salt converted into sulphate of peroxide by sulphuric and nitric acid, as directed by the Edinburgh Pharmacopœia for preparing *Ferrugo.* Fifty-two minims of each solution will convert into Prussian blue all the acid contained in 100 minims of the Edinburgh acid. The inhalation of ammonia or diluted chlorine combined with cold affusion of the head and chest, has seemed the only other efficacious treatment.

The physiological effects of medicinal doses have not hitherto been well determined, and its therapeutic applications would require more exact inquiry than any yet instituted. Single doses cause a peculiar irritation in the throat, sometimes a sense of stiffness or fulness of the tongue, occasionally nausea; and when long continued, salivation has been sometimes apparently produced. It has been extensively used in a great variety of diseases usually benefited by calmatives and antispasmodics; and in these diseases it has been commonly considered to reduce the force of the circulation, to allay nervous irritability, to soothe pain, to subdue spasm, and at the same time to stimulate the digestive functions and gently

move the bowels. Its chief employment has been in the treatment of cough of every kind, and of the form of dyspepsia connected with morbid irritability of the stomach. In the cough of pneumonia, catarrh, phthisis, cynanche laryngea, asthma, and hooping cough it has been used by many with apparently good effects; and it is certainly of service where the cough is of a nervous nature, depending on irritability, and confirmed by habit,—more especially for example in advanced hooping cough, asthma and chronic catarrh. Its most unequivocal effects in my own hands have been obtained in dyspepsia from irritability, marked by pain soon after meals, or by heartburn and pyrosis, as well as by the rejection of food very soon after it is swallowed. For these symptoms, and in chronic vomiting, either connected or not with organic disease, it is undoubtedly a useful remedy. It is sometimes also serviceable in the several varieties of neuralgia, in palpitation, especially depending on functional derangement merely, in hysteria, in rheumatism as a sedative anodyne, in lumbricus as an anthelmintic. As an external application, it has been recommended particularly by Dr Thomson of London, and, according to my experience, with good reason, for allaying the irritation which attends many chronic eruptive diseases; and others have found it beneficial in moderating the pain of cancerous and other painful ulcerations. On the whole my own experience of it as an internal remedy leads me to doubt whether ulterior observation will justify the sanguine statements which have been made by many respectable authors in regard to its virtues in most of the diseases now mentioned. That it may be compared with opium as an anodyne and hypnotic, as some maintain, is an extravagant assertion. But it must be admitted to be useful in most forms of chronic and spasmodic cough, as well as in painful digestion. An opinion much to the same effect has been expressed by an accurate and cautious author in therapeutics, M. Mérat, as the result of his practical experience and extensive literary researches.

The method of administering hydrocyanic acid is to commence with one or two drops in a tablespoonful of some simple menstruum, and to increase the dose by one drop at a time till some physiological or therapeutic effect be manifested. The most common effect first observed is a peculiar impression on the back of the throat, with sluggishness in the movements of the tongue. Since its effect passes swiftly off, it must be repeated often, not less than once in three hours; and in severe cases of irritative cough and neuralgia it has been given hourly or oftener. There is no distinct evidence of its being a cumulative poison, though this has been at times suspected. Its operation must be diligently watched at first till the proper dose be ascertained: This is the only secret for using it with safety and confidence. Some administer it in medicated potions; but it is better to give it with water only, or with the simple addition of sugar. As a measure of prudence, a small quantity

only should be entrusted at one time to the patient or his attendants. The strength for a lotion for eruptions or painful ulcerations is one part of the medicinal acid in two hundred parts of water, which may be increased afterwards to twice or thrice that proportion.

The doses of its only officinal forms are, *Acidum Hydrocyanicum*, E. *Acidum Prussicum*, D. min. i. ad min. v.—*Acidum Hydrocyanicum dilutum*, L. min. ii. ad min. viij.

ACIDUM MURIATICUM, *E.* *Hydrochloric acid of commerce.*

TESTS, *Edin.* Density at least 1180. It is always yellow, and commonly contains a little sulphuric acid, oxide of iron, and chlorine.

ACIDUM MURIATICUM PURUM, *E.* ACIDUM HYDROCHLORICUM, *L.* ACIDUM MURIATICUM, *D.* *Pure Muriatic Acid.*

TESTS, *Edin.* Density 1170: nearly or entirely colourless: without action on gold-leaf: not precipitated with solution of nitrate of baryta, if previously diluted with distilled water.

TESTS, *Lon.* Without colour, or residuum, when evaporated: not precipitated, when diluted, by ammonia, sesquicarbonate of ammonia, or chloride of barium: without action on gold-leaf or sulphate of indigo: Density 1160: one hundred grains neutralize 132 of carbonate of soda (121 grains, *Dub.*)

PROCESS, *Edin.* Purify muriate of soda by dissolving it in boiling water, concentrating the solution, skimming off the crystals as they form on the surface, draining from them the adhering solution, and washing the crystals slightly with cold water. Take of this salt previously well dried, of pure sulphuric acid, and of water, equal weights: put the salt into a glass retort, and add the acid previously diluted with a third part of the water and allowed to cool. Fit on a receiver which contains the rest of the water. Distil with a gentle heat by means of a sand-bath, or a naked coal-gas flame, so long as any liquid passes over, preserving the receiver cool by snow or a stream of cold water.

PROCESS, *Lond. Dub.* Take of
Dried chloride of sodium two pounds (100 parts, *D.*)
Sulphuric acid 20 ounces (87 parts, *D.*)
Water 24 fluidounces (120 parts, *D.*)
To the chloride contained in a retort add the acid previously diluted with half of the water, and put the rest of the water into the receiver. Distil from a sand-bath with a gradually increasing heat [till the retort become red, *Dub.*]

ACIDUM MURIATICUM DILUTUM, *E. L. D.* *Diluted Muriatic Acid.*

PROCESS, *E. L. D.* Take of
Muriatic acid four fluidounces (ten measures, *D.*)
Distil. water 12 fluidounces (11 meas. *D.*)
Mix them together. Density of the Dublin acid 1080.)

FOR. NAMES.—*Fr.* Acide Hydrochlorique; Ac. Chlorhydrique.—*Ital.* Acido idroclorico; Ac. marino.—*Ger.* Salzsäure.—*Dut.* Zootzuur.—*Russ.* Solnaia kislota.—*Tam.* Oopoo travagum.

MURIATIC ACID (Spirit of salt; Depurated acid of salt,) has received a variety of scientific and pharmaceutic names since the reformation of chemical nomenclature. The Edinburgh and Dublin Colleges have both retained the name first assigned to it; but the London College, in accordance with the principle followed throughout its Pharmacopœia, has substituted the most received designation of scientific chemistry. The folly of veering with every change of scientific nomenclature is well exemplified in the present instance. For the term Hydrochloric acid had been scarcely in-

troduced into the language of English pharmacy, before a conviction began to prevail that a better may be found for the purposes of science; and in French treatises this acid is now generally called the Chlorhydric acid.

Chemical History.—Muriatic acid, when pure and under ordinary atmospheric pressure, exists in the form of a colourless gas, of a suffocating acrid odour. It forms grayish fumes on escaping, because it unites with the moisture of the air and becomes visible vapour by condensation. It is discharged naturally from fissures in the neighbourhood of volcanoes; and is obtained artificially by heating the muriatic acid of commerce or a mixture of sulphuric acid and sea-salt, and collecting the evolved gas over mercury. Its density is 1269.5. It is liquefied under a pressure of forty atmospheres. It consists of equal volumes of chlorine and hydrogen, that is one equivalent, or one part by weight, of hydrogen, and one equivalent, or 35.84 parts of chlorine. This gas has a very powerful affinity for water, which at 40° absorbs 480 times its volume, with the evolution of considerable heat. The solution thus obtained is muriatic acid in its ordinary or liquid form.

Liquid muriatic acid is admitted into the Pharmacopœias in three forms; in that of commercial acid, pure acid, and diluted acid. The first or commercial muriatic acid, though not recognised in the Pharmacopœias of London and Dublin, is properly admitted into the list of the Materia Medica by the Edinburgh College; because, although not perfectly pure, it is sufficiently so for all medicinal and most pharmaceutic purposes. It is obtained in great abundance on the large scale by condensing in water the muriatic acid gas which is disengaged in the course of the conversion of sea-salt into sulphate of soda, preliminary to the preparation of black-ash and carbonate of soda. Commercial muriatic acid is a transparent liquid of a yellow colour, which disappears under moderate dilution. It possesses an intense acid taste and a peculiar suffocating odour, which causes the glottis to contract; but its vapour may be inhaled when considerably diluted. When exposed to the air it emits muriatic acid gas, which forms fumes like those already described. Its density varies from 1180 to 1216. That of 1200 contains forty per cent of real anhydrous acid and is composed very nearly of one equivalent of acid and six equivalents of water. It freezes at —60°. At 110° it seems to boil, but merely gives off pure hydrochloric acid gas, which it continues to do till the density sinks to 1094; and then it boils in the proper signification of that term, and distils over unchanged. It is highly irritating and corrosive, though less so than sulphuric and nitric acids. It unites with water in all proportions, and heat is disengaged, but not so much as in the case of sulphuric acid. It dissolves some metals and most metallic oxides; but some peroxides, such as that of manganese, are decomposed and at the same time decompose the hydrochloric acid, chlorine being given off and a hydrochlorate formed

with a metallic oxide of a lower degree of oxidation. It commonly dissolves gold-leaf, especially with the aid of a gentle heat. It is a powerful solvent of the active part of those plants whose virtues depend on an alkaloidal or neutral crystalline principle.——Its best test when diluted is the solution of nitrate of silver, which occasions a heavy white precipitate of chloride of silver, insoluble in nitric acid, cold or boiling.

Pure muriatic acid, which is also admitted into the Edinburgh Pharmacopœia, and which is the only variety acknowledged by the other colleges, does not differ essentially from the commercial kind in its properties, except that it is colourless, without action on gold-leaf, and, when of pharmaceutic strength, less powerfully fuming. It acquires a faint yellowish tint when long kept, owing to chlorine being formed by decomposition of the acid. All the colleges have a formula for preparing pure muriatic acid; but that of Edinburgh is the only one which will yield it of perfect purity. Muriate of soda as met with in commerce almost always contains more or less nitrate of soda, and sometimes a considerable proportion; in which case, when decomposed by sulphuric acid, chlorine is evolved and condenses in the receiver with the muriatic acid. Mere desiccation of the salt, as enjoined by the London and Dublin Colleges, will not remove this impurity; the salt must be exposed for some time to a full red heat, before the nitrate is thoroughly decomposed. This was the method advised in the old Edinburgh Pharmacopœia. But an easier way of accomplishing the same end is to crystallize the salt anew and wash the crystals before they are dried. With such salt a perfectly colourless acid may be obtained, which is quite free of chlorine. The patent salt of the grocers' shops is also sufficiently pure for this purpose. Another neglect on the part of the London and Dublin Colleges, if their object be to obtain a pure product is, that they do not direct the sulphuric acid to be freed of nitrous acid. For, as will be seen under the head of sulphuric acid, the commercial qualities of that article in Britain often contain nitrous acid; and the proportion, though small, is nevertheless sufficient to cause a manifest impregnation of chlorine in the muriatic acid. In following out the process for preparing pure muriatic acid, the whole water may be put into the receiver, and the acid alone added to the salt in the retort. But the evolution of gas in this way is so sudden and violent as to be troublesome in operations on the small scale, since it becomes necessary to add the sulphuric acid in small successive portions. By introducing into the retort, as the Colleges direct, a portion of the water previously mixed with the sulphuric acid, and allowed to cool, the escape of gas is moderated, much of it passes over in combination with water, and the rest is so effectually condensed by the water in the receiver, that extremely little will be found to issue at the joinings, provided the receiver be kept cool. A Wolffe's apparatus is not at all necessary, as some represent. The retort ought to be twice

as capacious as the bulk of the materials in it; and the receiver must not be too closely fitted. The proportions directed in all the pharmaceutic formulas, imply the use of more sulphuric acid than is necessary to decompose the whole muriate. But in this way less heat is required, and the residuum is more easily dissolved by adding boiling water when the apparatus has cooled a little. The residuum may be used for obtaining sulphate of soda.

By following the Edinburgh formula I have very regularly obtained a colourless acid, quite free of chlorine or sulphuric acid, and of the density 1169 or 1170. By heating one portion of such acid, and receiving the evolved gas in another portion kept cold, it is easy to increase the proportion of the acid till the density rises to 1200, 1210, or even 1218. But acid of that strength does not keep well at atmospheric temperatures, gradually parting with some of its gas, and becoming at length of the density 1192 (Berzelius).

A convenient formula for a pure acid is that of Dr Gregory, who uses four ounces of patent salt and five fluidounces of sulphuric acid of density 1600, in a common flask connected by a bent tube with a cooled bottle containing two fluidounces of distilled water. The product is three fluidounces of colourless fuming acid of density 1200 to 1210. A further quantity of a weaker but still pure acid may be got by continuing the distillation into a fresh portion of water. The ordinary acid of commerce yields a weak but pure acid by diluting it to the density 1094 and distilling. When of this density it passes over without suffering loss of strength. The first portions should be rejected.

The strength of the pure as well as commercial muriatic acid is most correctly ascertained by its solvent power over marble in fine powder. Of the real or anhydrous acid 36.42 parts are indicated by the solution of 50.6 parts of marble, that is, very nearly five parts by seven. For all ordinary purposes however the strength may be measured by the density. The following table represents the percentage of anhydrous acid or muriatic acid gas contained in liquid acid of various degrees of density, as ascertained by Mr Edmund Davy; and likewise the percentage of liquid acid of the density 1200, from a table by Dr Ure.

Density.	Anhyd. ac. per cent.	Per cent. of acid of 1200.	Density.	Anhyd. ac. per cent.	Ac. of 1200 per cent.
1210	42.43		1100	20.20	50
1200	40.80	100	1090	18.18	45
1190	38.38	95	1080	16.16	40
1180	36.36	89	1070	14.14	35
1170	34.34	84	1060	12.12	30
1160	32.32	79	1050	10.10	25
1150	30.30	74	1040	8.08	20
1140	28.28	70	1030	6.00	15
1130	26.26	65	1020	4.04	10
1120	24.24	60	1010	2.02	5
1110	22.22	55			

The Colleges have all admitted a diluted muriatic acid for internal use. It might have been desirable that the Colleges had not differed in the degree of dilution they recognize. The London and Edinburgh Colleges have adopted a preparation of convenient strength, consisting of one part by volume of acid to four of water, and about the density of 1050. The diluted acid of the Dublin College is too strong for convenience in dispensing.

Adulterations.—Commercial muriatic acid, by reason of its extreme cheapness, is seldom adulterated intentionally. But it is subject to contain various impurities, which must be attended to in respect of certain pharmaceutic processes for which it is thus rendered unfit.——It usually contains a little iron, generally however a mere trace. This is supposed by some to be the cause of its yellow colour; but the colour is sometimes deep when the quantity of iron is so small as to be incapable of accounting for it. Iron may be detected by the blue colour and precipitate occasioned by ferrocyanate of potash in the neutralized acid.——A more important foreign ingredient is chlorine, derived from the presence of nitric acid in the sulphuric acid, or of a nitrate in the muriate of soda, and the consequent reaction of the nitric and muriatic acids on one another. This impregnation too has been supposed to occasion the colour of commercial muriatic acid; and it may be one cause. Yet some specimens strongly loaded with chlorine become colourless when distilled, although the impregnation of chlorine does not disappear, as some incorrectly allege, in the distilled liquid. Chlorine is discovered by the acid dissolving gold leaf, especially when aided by a gentle heat; it is also indicated by the acid decolorizing the solution of sulphate of indigo; and both of these tests have been admitted by the London College.——Sulphurous acid, also a frequent impurity, is detected by adding to half an ounce of the acid two drachms of crystallized protochloride of tin, and then diluting the mixture with two fluidounces of water. The presence of sulphurous acid is shown by the salt rendering the muriatic acid yellow, and the water renders it brown, a brown precipitate of sulphuret of tin subsequently falling [Girardin].—The only other impurity of any consequence is sulphuric acid, which, being employed in preparing it, is apt to be spurted up into the beak of the retort, or carried over by too strong heat applied towards the close. It is known by the nitrate or muriate of baryta occasioning a white precipitate. Before using this test the acid must be diluted with four or five waters, otherwise a crystalline precipitate of muriate of baryta may be caused by the acid attracting the water in which the salt is dissolved.——Saline matters are met with in some commercial acids, and when abundant must be regarded as intentional adulterations, probably introduced to increase the density. They are best detected by distilling the acid to dryness, and examining the crystalline residuum. The yellow colour of muriatic acid has been ascribed by some to a trace of bromine; which appears an improbable explanation.

Actions and uses.—Muriatic acid in the concentrated state is powerfully corrosive and irritant in its action. It dissolves most animal textures both in the dead and in the living body. Hence it is a powerful poison, either when swallowed in the liquid form, or when inhaled in the state of gas. Its antidotes are the same with those for sulphuric acid. It is equally energetic as a poison to vegetable life. Most vegetables are injured by extremely small proportions of it: The foliage of various plants is completely destroyed by exposure for 48 hours to an atmosphere containing only a 20,000th of muriatic acid gas (Dr Turner and the Author). The irritant and corrosive actions of the strong acid have been applied successfully to the treatment of some local diseases. Thus it is an approved application in some obstinate ulcers of the tongue, in cancrum oris, and in certain syphilitic and mercurio-syphilitic ulcerations of the throat. Many practitioners prefer to use it in these affections considerably diluted; in which state it is also susceptible of several other applications to the treatment of topical diseases. Thus, the diluted acid is a favourite application with many as a gargle for the sore throat of scarlatina maligna, for aphthæ and diphtheritis, and for elongated uvula. Like nitric acid, but not so frequently, the strong muriatic acid has been employed for altering the character of the ulceration of phagedæna gangrenosa.——Internally muriatic acid has been thought an efficacious tonic and refrigerant in continued fever and certain eruptive fevers, such as scarlatina. Dr Paris reports favourably of its effects in these diseases. By the chemical physicians of last century, it was currently used as an antiseptic in scurvy and petechial fever, or wherever putrescence of the fluids was imagined to exist. It has been long generally employed in the variety of urinary gravel in which the deposit from the urine consists of the earthy phosphates. At first physicians imagined its good effects were simply owing to the acid passing off with the urine and thus keeping the otherwise solid phosphates in solution. But we now know that it does not pass off with the urine in a free state; if the urine be alkaline, as generally is the case in phosphatic gravel, it is not rendered acid; and consequently any good effect which results must be owing to the general action of the muriatic acid as a tonic and promoter of digestion.—It is one of the acids which have been employed in the form of vapour for disinfecting apartments. Guyton-Morveau first proposed it for this purpose in 1773; and though not much employed now-a-days, there is no reason for doubting its utility. But chlorine and nitric acid are probably more energetic.

When applied in the concentrated form to ulcers and the like, the best mode of using it is to touch the diseased part with a little fragment of sponge soaked in it. A gargle may be made with one or two drachms to twelve ounces of water and two ounces of syrup. When taken internally, sugar is the best corrective of its strong, acid taste. It ought to be sucked through a quill or glass tube, to

prevent injury to the teeth. Fumigations may be accomplished by placing in a shovel of hot sand either the commercial acid or equal weights of salt and sulphuric acid; and ten ounces of salt were conceived by Guyton to yield acid enough for disinfecting an apartment containing twenty beds. This acid is most extensively used for various important purposes in chemical pharmacy.

The officinal forms and doses are the following: *Acidum muriaticum*, gutt. xv. *Acidum muriaticum dilutum*, D. gutt. xl. *Acidum muriaticum dilutum*, E. *Acidum Hydrochloricum dilutum*, L. dr. i.

ACIDUM NITRICUM, *E.* *Nitric acid of commerce.*

Tests, *Edin.* Density 1380 to 1390; colourless or nearly so; when diluted with distilled water it precipitates but slightly, or not at all, with solution of nitrate of baryta, or of nitrate of silver.

ACIDUM NITRICUM, *L. D.* ACIDUM NITRICUM PURUM, *E.* *Pure Nitric acid.*

Tests, *Edin.* Colourless or pale yellow; density 1500; when diluted with distilled water it is not precipitated by solution of nitrate of baryta, or of nitrate of silver.

Tests, *Lond.* Entirely vaporizable; diluted with distilled water, it is not precipitated by nitrate of silver or nitrate of baryta; density 1500; one hundred grains saturate about 217 grains of crystallized carbonate of soda.

Process, *Edin.* Purify nitrate of potash, if necessary, by two or more crystallizations, till nitrate of silver does not precipitate its solution in distilled water. Put into a glass retort equal weights of this purified salt and of sulphuric acid. Distil into a cooled receiver with a moderate heat from a sandbath or naked gas-flame, so long as the fused material gives off vapour. The pale yellow acid thus obtained may be rendered colourless, should this be desired, by heating it gently in a retort.

Process, *Lond.* Mix in a glass retort two pounds of dried nitrate of potash and of sulphuric acid, and distil from a sand-bath.

Process, *Dub.* Mix in a glass retort one hundred parts of nitrate of potash and ninety-seven of commercial sulphuric acid, and distil into a receiver connected with a pneumatic apparatus till the residuum, after concreting, again liquefies. Density 1490.

Acidum Nitricum Dilutum, E. L. D.

Process, *Lond. Edin.* Mix together nine fluidounces of distilled water and one fluidounce of pure nitric acid (or one fluidounce and five fluidrachms and a-half of commercial nitric acid, E.) Density 1077, *Edin.*

Process, *Dub.* Mix together three parts by measure of (pure) nitric acid and four of distilled water, avoiding the fumes. Density 1280.

Unguentum Acidi Nitrici, D.

Process, *Dub.* Take of
Olive oil a pound,
Prepared axunge four ounces,
Nitric acid five drachms and a-half by measure.

Melt the axunge and oil together in a glass vessel; when the mixture is nearly concrete, add the acid, and stir briskly with a glass rod till the whole solidifies.

For. Names.—*Acidum Nitricum*—*Fr.* Acide nitrique.—*Ital.* Acido nitrico.—*Ger.* Salpetersäure.—*Dut.* Salpeterzuur.—*Russ.* Selitrennaia kislota.—*Arab.* Maulabker.—*Pers.* Areki shora.—*Tam.* Pottle oopoo travagum.

Acidum Nitricum dilutum—*Fr.* Eau forte.—*Ital.* Acqua forte.—*Ger.* Scheidewasser.—*Dut.* Sterkwater.—*Russ.* Krepkaia vodka.

Nitric acid (Acid Spirit of Nitre: Aqua fortis,) seems to have been known in the diluted state to the Arabians in the eighth century, and to have been first obtained in a state of considerable concentration by Reymund Lully five centuries later. Two varieties

are in general use, the strong and the diluted acid. The London and Dublin Colleges admit only one form of the strong acid, the pure concentrated acid of the density 1500; but the Edinburgh Pharmacopœia has more correctly admitted also a form somewhat weaker, about the density 1390, because this is now universally used by druggists in all the three kingdoms, almost to the exclusion of the stronger form, and it is equally available for most pharmaceutic and all medicinal purposes. The London and Edinburgh Colleges have also a diluted acid, which contains about eleven per cent of anhydrous acid, and which is convenient for dispensing; but the Dublin diluted acid is much stronger, as it contains about thirty-eight per cent.

Chemical History.—Nitric acid is obtained by decomposing nitrate of potash or soda with sulphuric acid aided by heat. Much has been written as to the best proportions for facility and economy. But the question is now well understood, so that it is scarcely necessary to reproduce the whole inquiry in this place. In manufacturing nitric acid on the large scale from nitre it may be an advantage to save the bulkiness of the apparatus and the consumption of sulphuric acid, by using that acid in such proportion as leaves a neutral sulphate of potash in the retort,—consequently in the proportion of about one part by weight of sulphuric acid and two parts of nitre. But if the proportion of sulphuric acid is doubled, so that a bisulphate of potash is left in the retort, less heat is required to decompose the whole salt; a greater weight of acid is distilled over; the acid obtained is very slightly nitrous; and, in consequence of the residuum being left in the form of bisulphate, it may be much more readily dissolved out without breaking the retort. These advantages are of no small consequence in operations on the ordinary scale of a chemist's laboratory. I can add my testimony to that of others in favour of the facility and economy of the process now adopted by all the British Pharmacopœias. Even working on so small a scale as with seven ounces of nitre I have obtained 99 per cent of the acid contained in the salt by theory; its density was 1502; and it had only a pale straw-yellow tint.—— The nitre of commerce, usually found in the shops, is contaminated with a muriate, probably of potash; which will cause an impregnation of muriatic acid in nitric acid prepared from it. To prevent this the Edinburgh College directs repeated crystallization, till a solution of the salt no longer indicates the presence of muriatic acid when tested with nitrate of silver; and two crystallizations will commonly be found requisite.—The retort used in this process is apt to be broken unless care be taken in removing the bisulphate of potash which is left. The surest mode to save it is to allow the fused salt to cool a little, and then to add boiling water, but very gently at first on account of the violent ebullition.

Nitrate of soda, owing to the lower atomic weight of its base, yields a larger proportion of acid than nitrate of potash, and is

therefore now preferred by manufacturers. If the commercial salt be purified by a single crystallization, and the sulphuric acid used in the proportion of two equivalents to one of the salt, the full theoretical quantity of strong nitric acid may be obtained, without any of the frothing up of the materials which has been complained of by some [Maclagan].

According to Pelouze pure nitric acid of full density may be got by distilling the commercial acid previously mixed with four or five times its weight of sulphuric acid.—It may be freed from chlorine by simple distillation, rejecting the first eighth or fourth part according to its original quality [Barreswil]; but this is more effectually accomplished and at very little cost by previously adding to it a little nitrate of silver. Nitrous acid may be entirely removed by passing a current of carbonic acid gas through a bottle of the strong and otherwise pure acid kept at a temperature near its point of ebullition [Millon.]

Nitric acid is colourless when pure, emits gray fumes of an irritating, peculiar odour, and possesses an intensely acid, corrosive taste. It quickly turns the skin yellow, and soon corrodes and dissolves this, as well as all other soft animal textures. The yellow tint of the skin is indelible except by gradual attrition; and it may be known by becoming much brighter under the action of ammonia, or of soap. The density of the strongest acid is variously stated, but probably 1500 is the densest which can be obtained free of nitrous acid. When impregnated with nitrous acid, however, it may be got so heavy as 1540 or upwards; and it has then a yellow colour and emits copious orange fumes. The pure colourless acid slowly undergoes decomposition under exposure to light; oxygen gas is disengaged, and nitrous acid formed, which remains in the fluid, imparting a yellow colour. Its boiling and freezing points vary with the strength. The strong acid concretes at —50°, and boils at 248°; but a boiling temperature decomposes it in the same manner as the gradual action of light. A weak acid parts with a feebly acidulated water in the first instance, when an attempt is made to distil it; and when the residuum reaches the density of 1420, it passes over unchanged. An acid loaded with nitrous acid, if exposed to a temperature short of ebullition, parts with nearly the whole nitrous acid in the form of orange fumes, and at length becomes nearly colourless; but complete deprivation of colour cannot be attained without a considerable part of the nitric acid also being discharged. Nitric acid unites readily with water, much heat being at the time evolved, though considerably less than in the case of sulphuric acid. It oxidates most of the metals, dissolves the greater part of them, and at the same time undergoes decomposition, nitric oxide gas being evolved, and forming ruddy, suffocating fumes on coming in contact with the atmosphere. It unites with bases, and forms salts, most of them neutral, and many crystalline. It is not hitherto known in any other condition

than that of a hydrate; and it is supposed to consist, in its most concentrated state, at the density of 1500, of one equivalent of real nitric acid and one equivalent and a half of water, that is 54+13.5; so that it contains about 80 per cent of anhydrous acid. Radical nitric acid consists of one equivalent of nitrogen and five equivalents of oxygen (NO^5), or 14+40.—Nitric acid may be readily distinguished on the small scale from other mineral acids, by its action on morphia, which it immediately turns orange or yellow, or by the effect of brucia, which imparts to it a blood-red colour.

The ordinary nitric acid of the shops (nitric acid of commerce, E.) differs somewhat from that just described. It is commonly colourless, fumes but slightly, and undergoes little change under exposure to light. The reason is, that it contains a greater proportion of water, as is shown at once by its density. Its usual density is from 1380 to 1390; the latter of which contains about 54.5 per cent of anhydrous acid. This difference of strength between it and the concentrated acid must be carefully kept in view in many chemical and pharmaceutic operations.

The diluted acid of the Pharmacopœias has faintly the odour proper to the stronger forms, but the same intense acid, corrosive taste. It is quite colourless. The Colleges have unfortunately differed as to the strength of this preparation. The Edinburgh College has adopted in its new edition the formula of the London College, which yields an acid of the density 1077, and containing 11.16 per cent of anhydrous acid. The Dublin College retains the old *aqua fortis* of the shops, which is more than thrice as strong, but is much less convenient to keep for dispensing in a laboratory.

The strength of nitric acid may be accurately ascertained by means of the density. On this account a tabular scale has been constructed by Dr Ure, from which the following abridged table has been drawn up, showing the per centage of radical or anhydrous acid, at various degrees of density:—

Dens.	Ac. in 100.	Dens.	Ac. in 100.	Dens.	Ac. in 100.
1500	79.700	1378.3	52.602	1183.3	25.504
1496	78.106	368.1	51.068	1170.9	23.910
1491	76.512	357.9	49.414	1158.7	22.316
1485	74.918	347.7	47.820	1146.5	20.722
1479	73.324	337.6	46.226	1134.5	19.128
1473	71.730	327.0	44.632	1222.7	17.534
1467	70.136	316.3	43.038	1110.9	15.940
1460	68.542	305.6	41.444	1099.3	14.346
1453	66.948	294.7	39.850	1087.8	12.752
1446	65.354	282.6	38.256	1076.4	11.158
1438.5	63.760	270.5	36.662	1065.1	9.564
1430.6	62.166	258.3	35.068	1054.0	7.970
1422.8	60.572	246.2	33.474	1043.0	6.376
1414.7	58.978	234.1	31.880	1032.0	4.782
1406.5	57.384	221.2	30.286	1021.2	3.188
1397.8	55.790	208.4	28.692	1010.6	1.594
1388.2	54.196	1195.8	27.098	1005.3	0.797

Adulterations.— The adulterations of nitric acid usually met with are of no consequence in relation to any medicinal object to which the acid is applied, and are also unobjectionable for most pharmaceutic purposes. But they will render it unfit for some processes in pharmacy, and for many of its applications as a pharmaceutic and medico-legal test. They are chiefly water, nitrous acid, sulphuric acid, and muriatic acid. The first is detected by the density, and the second by the colour being yellow or orange. Sulphuric acid is best indicated by diluting the suspected specimen with eight times its volume of distilled water, and testing with solution of nitrate of baryta, which will throw down a white precipitate if any sulphuric acid be present. Muriatic acid is indicated in like manner by testing the diluted acid with nitrate of silver. The London College has directed the muriate of baryta to be used for sulphuric acid, instead of the nitrate; but it is less convenient, because after adding the nitrate of baryta for sulphuric acid, the silver salt may be used for muriatic acid in the same quantity of material, but not if muriate of baryta be employed. The additional characters given by the same College, namely, the absence of any residuum after evaporation, and the neutralizing power, are scarcely necessary. In point of fact, the commercial acid is at present prepared of great purity except in so far as it is somewhat diluted. The precipitates occasioned by nitrate of silver or of baryta are always scanty, and sometimes scarcely perceptible; nor does it seem probable that adulterations of a fixed nature obtain admission either accidentally or intentionally. If they did, a necessity would arise for checking the test of the density by the degree of acidity, as proposed in the London Pharmacopœia.

Actions and Uses.—Nitric acid is in its action corrosive, irritant, tonic, refrigerant, and according to some, specific in respect of two diseases, syphilis and chronic hepatitis. As a corrosive it is a very dangerous poison, producing death sometimes in a brief space from general constitutional disturbance, or more slowly from exhaustion consequent on extensive organic mischief in the gullet, stomach, or intestines. Its proper antidote is magnesia, carbonate of magnesia, chalk, or bicarbonate of potash or of soda. The diluted acid may also prove poisonous by inducing inflammation as an irritant, though it be not strong enough to corrode.

Its corrosive and irritant actions have been extensively applied in the treatment of diseases. It may be used for destroying warts, and for cauterising poisoned wounds. It is one of the best applications for the cure of phagedenic ulcers (Welbank); for which purpose the surface of the sore, after removal of the slough, is covered with a pledget soaked in the strong acid, until a firm dry crust be formed; and the sore is then treated with calamine ointment or weak lotions of nitrate of silver. It has been also employed by some for destroying the crust of porrigo of the scalp, and restoring healthy action to the affected integument. In a diluted

state advantage has been derived from it in the treatment of indolent ulcers, especially for destroying their callous edges, and likewise in the treatment of caries of the bones. In the shape of ointment, made with sixteen times its weight of olive oil and axunge, as directed by the Dublin Pharmacopœia, it has been found a useful stimulant dressing for various chronic eruptions. Among its external uses may be also enumerated its employment for fumigating infected apartments. It is probably the best of the disinfecting gases or vapours, and it may be disengaged throughout the air of an apartment without the previous removal of the sick. The readiest mode of using nitric acid vapour for fumigating a room is to put into a shovelful of hot sand an earthenware pot containing for a cubic space of ten feet half an ounce of nitre and as much sulphuric acid.

As a tonic and refrigerant, nitric acid is administered internally in continued fever with frequent advantage. Two to five drops of the concentrated acid, or one or two fluid-scruples of the London and Edinburgh diluted acid in a tumbler of water make a good acidulous drink in most febrile diseases; and the same amount given every two hours in less water, but sweetened with sugar to take off the sharpness of its acidity, has seemed beneficial as a general tonic in the typhoid form of continued fever. Through its tonic action on the stomach it proves useful in cases of phosphatic gravel. Its good effects are here occasionally undoubted, and were supposed at one time to depend on its rendering the morbid urine acid. But doubts are entertained whether the alkaline urine which attends phosphatic gravel can be rendered acid by any such means, and I can bear testimony to nitric acid having always failed to effect such change in my hands. It does however pass off by the urine when taken in poisonous doses (Orfila). Its tonic action upon the stomach is possibly likewise the source of the benefit occasionally obtained from it in chronic hepatitis. The treatment of that disease by nitric acid, first proposed not many years ago by Mr Scott of Bombay, has gone out of fashion. Yet it has seemed to me sometimes serviceable; and even in irremediable cases of chronic enlargement of the liver it proves useful in cleaning the tongue, improving the appetite, abating thirst, and sometimes retarding the progress of the disease. Nitric acid is one of the remedies which have been proposed as substitutes for mercury in the treatment of the venereal disease. It certainly seems to have proved of service in the hands of many practitioners, especially in cases complicated with the scorbutic or strumous diathesis [Holst]; yet a different explanation may be given of its apparent good effects, now that we are acquainted with the frequent sanability of syphilis under simple local treatment combined with a well-ordered diet and regimen. Besides curing the syphilitic disease, it has been held to possess the property of mitigating the physiological action of mercury on the mouth and salivary organs; but this doctrine

requires confirmation. It is much used by some as a tonic in chronic diseases and in convalescence; and it is a good refrigerant in the sweating of hectic and irritative fever, though inferior in this respect to sulphuric acid.

The preparations and doses of nitric acid are the following:— *Acidum nitricum*, gutt. v. ad gutt. xx. *Acidum nitricum dilutum*, D. gutt. x. ad gutt. xl. *Acidum nitricum dilutum*, E. L. dr. ss. ad dr. ii. *Unguentum acidi nitrici*, D. for external use.

ACIDUM NITROMURIATICUM, *D.* *Nitromuriatic Acid.*

PROCESS, *Dub.* Take of
Nitric acid, one part by measure;
Muriatic acid, two parts.
Mix them in a cooled vessel, and preserve the mixture in a cool dark place, in a well-closed bottle.

FOR. NAMES.—*Fr.* Eau régale.—*Ital.* Acqua regia.—*Ger.* Königswasser.

NITROMURIATIC ACID [Nitrohydochloric acid. Aqua regia] seems to have been known to the Arabians in the eighth century, as they were acquainted with a solvent of gold.

It is prepared by mixing together nitric and muriatic acids. Various proportions are used according to the purpose to which the acid is to be applied. The proportions adopted by the Dublin College are convenient for general as well as medical use. The result is not a mere mixture of the two acids: For the muriatic acid is resolved into chlorine and hydrogen, the nitric acid into nitrous acid and oxygen; water is consequently formed; and if the muriatic and nitric acids be used in their correct equivalent proportions, the water holds in solution nothing but chlorine and nitrous acid. Of course there may be an excess of either of the acids employed for preparing nitromuriatic acid. It is easily distinguished from other acids by its suffocating odour of chlorine, and its property of promptly dissolving gold. It readily parts with its chlorine, unless preserved in very close bottles; and if concentrated acids be used for making it, the loss of chlorine is rapid, especially under an elevation of temperature;—so that dilution with one or two volumes of water is advisable when it must be kept long.

Nitromuriatic acid possesses the powerful corrosive, irritant action of the other strong mineral acids, and is a dangerous poison, either when swallowed, or when its emanations are inhaled. It was introduced into the Dublin Pharmacopœia in 1826, in consequence of its having been at the time a fashionable remedy in the form of foot-bath for the treatment of syphiloid disorders and chronic diseases of the liver. It was strongly recommended for these purposes not long before by Mr Scott of Bombay, and his recommendation brought it for a season into notoriety. But it is now, I believe, entirely abandoned. The usual method of applying it was in the form of a foot-bath, consisting of an ounce and a-half of the strong acid in a gallon of water, and continued daily for twenty minutes. It was sometimes also employed inwardly. A solution of a drachm of corrosive sublimate in an ounce of the

acid has been used as a cauterant for foul chancres. There seems no reason for retaining a formula for it in the Pharmacopœia.

ACIDUM PHOSPHORICUM DILUTUM, *L.* *Diluted Phosphoric acid.*

TESTS, *Lond.* The precipitate it forms with chloride of barium or nitrate of silver is easily dissolved by nitric acid. It does not affect a plate of silver or copper; and is not affected by sulphuretted hydrogen. Its density is 1064. One hundred grains saturate 42 of carbonate of soda, and no precipitation takes place.

PROCESS, *Lond.* Take of
Phosphorus, one ounce;
Nitric acid, four fluidounces;
Distilled water, ten fluidounces. Mix the acid and water in a glass retort, put it in a sandbath, add the phosphorus, and apply heat till eight fluidounces have passed over. Return the distilled fluid into the retort and distil over again eight fluidounces, which may be thrown away. Heat the residuum in a platinum capsule till two ounces and six drachms remain. When the acid has cooled, add distilled water to make up twenty-four fluidounces.

FOR. NAMES.—*Fr.* Acide phosphorique.—*Ital.* Acido fosforico.—*Ger.* Phosphorsäure.—*Russ.* Phosphornaia kislota.

PHOSPHORIC ACID was discovered by Marcgrav in 1740. It occurs, united with bases, in the three kingdoms of nature,—most abundantly in animals, least so in vegetables. The earth of bones is its most abundant source.

Chemical History.—It is obtained in a state of purity either by decomposing earth of bones with sulphuric acid, or by oxidating phosphorus with nitric acid. The London College, in introducing it for the first time into the Pharmacopœia, has adopted the latter process. It may be made by heating nitric acid in a covered platinum crucible, and projecting the phosphorus in successive small portions under the cover. But if it be wished to operate on a large quantity of phosphorus at once, it is better to dilute the acid as the London College directs, otherwise the action is violent and ungovernable. The chemical changes that ensue consist essentially in the decomposition of the nitric acid, the oxidation of the phosphorus by part of its oxygen, and the escape of the remaining oxygen along with the azote in the form of nitric oxide gas. It also appears, however, that some water is decomposed at the same time; the hydrogen of which unites with some of the azote of the nitric acid, to form ammonia. In order to remove this ammonia, as well as any excess of nitric acid, the product must be evaporated to dryness and then heated to redness. The concentration of the aqueous acid may be carried on safely in glass vessels till the solution consists of about equal parts of acid and water; but subsequently it attacks glass, so that vessels of platinum become necessary. At a red heat the properties of the acid are somewhat altered, although its chemical constitution is no further changed except that it contains less combined water than when in the state of phosphoric acid; but its properties as such are restored by solution in water.—— From earth of bones phosphoric acid may be obtained more cheaply, by decomposing the solution of acid phosphate of lime by sesqui-

carbonate of ammonia (see *Sodæ Phosphas*),—concentrating the filtered fluid which contains phosphate of ammonia, with a little sulphate,—and finally heating the residuum to redness in a platinum crucible; upon which the ammonia of the phosphate is expelled, together with the sulphate of that alkali. This, which is the ordinary process of chemists, might have been conveniently substituted for the more expensive method of the London Pharmacopœia.

Phosphoric acid in the diluted state, as recognized by the London College, is a transparent colourless liquid of the density 1064, without odour, but of an intense acid taste. The best characters for distinguishing it are the effects of nitrate of silver and sulphuretted-hydrogen gas. If it be saturated by ammonia, nitrate of silver occasions a yellow precipitate of phosphate of silver. Of all the acids arsenious acid is alone similarly acted on; and from this it is distinguished by the effects of sulphuretted-hydrogen gas, which causes a yellow precipitate with arsenious acid, but has no effect at all upon the phosphoric. When diluted phosphoric acid is concentrated till the temperature attains 300°, it acquires its greatest state of concentration, and assumes the appearance of a brown oily liquid. It then consists of one equivalent of acid and three of water; and may be obtained in the form of scaly crystals by evaporation in vacuo. If an attempt however be made to deprive it of more water by a higher temperature, such as a long-continued heat of 415°, one equivalent of its water is disengaged, and the acid acquires new properties; for example, the nitrate of silver no longer occasions a yellow precipitate. As no change takes place in the fundamental elements of the acid in these circumstances, the product of the action of heat has been called Pyrophosphoric acid. When the heat is raised to redness, another equivalent still of water is expelled, and properties are acquired which distinguish the acid from both the previous forms, although its oxygen and phosphorus continue as before unchanged. The modification thus produced has been called Metaphosphoric acid (Graham). All these forms consist essentially of two equivalents of phosphorus and five of oxygen ($P^2 O^5$), that is 31.4 parts of the former and 40 of the latter. The form recognized by the London College contains also three equivalents of water, which are considered by Professor Graham to act the part of a base.

Phosphoric acid is liable to be adulterated with lime, from the source whence the acid is commonly obtained. This is detected by carbonate of soda added to saturation as the London College has directed; for the lime is then separated in the form of carbonate.

I am not aware what reasons led to the admission of this acid into the London Pharmacopœia; and I doubt whether the employment of it in Britain has ever been so general as to justify its introduction. It is corrosive, like other mineral acids, when given in large and concentrated doses. In small doses it is like them a tonic. By some it has been thought an antispasmodic, by others a

stimulant of the sexual system, by others again an improver of morbid secretions; and some conceive it useful for correcting the state of the urine in phosphatic gravel, because the earthy phosphates are soluble in an excess of their own acid. But all these applications of it rest upon an insecure foundation.

The doses of diluted phosphoric acid are min. xv. *ad* min. xxx.

ACIDUM PRUSSICUM, *D.* *See Acidum Hydrocyanicum.*

ACIDUM PYROLIGNEUM, *E.* *See Acidum Aceticum.*

ACIDUM SULPHURICUM. *Sulphuric acid of commerce.*

TESTS, *Edin.* Density 1840 or near it: colourless: when diluted with its own volume of water, only a scanty muddiness arises, and no orange fumes escape: when diluted with twelve volumes of water sulphuretted-hydrogen causes a white muddiness, but not a yellow precipitate.

TESTS, *Lond.* Sulphuretted-hydrogen scarcely colours it when diluted: Density 1845: Free of colour: Solids not above 2.5 in 1000.

ACIDUM SULPHURICUM PURUM, *E. D.*

TESTS, *Edin.* Density 1845: Colourless: dilution causes no muddiness: solution of sulphate of iron is not reddened at the line of contact when poured over it.

PROCESS, *Edin.* If commercial sulphuric acid contain nitrous acid, heat eight fluidounces of it with between ten and fifteen grains of sugar at a temperature not quite sufficient to boil the acid, until the dark colour at first occasioned shall nearly or altogether disappear. This process removes nitrous acid. Other impurities may be removed by distillation; which on the small scale is easily managed by boiling the acid with a few platinum chips in a glass retort by means of a sand-bath or gas-flame,— rejecting the first half ounce.

PROCESS, *Dub.* Distil commercial acid in a white glass retort and receiver without lute, rejecting the first twelfth, and moderating the ebullition with platinum chips in the retort. Density 1845. To be kept in well-closed vessels.

ACIDUM SULPHURICUM DILUTUM.

PROCESS, Take of
Sulphuric acid one fluidounce (one fluidounce and a-half, *L.* one part, *D.*)
Distilled water thirteen fluidounces (fourteen and a-half fluidounces, *L.* seven parts, *D.*)
Mix them together. Density about 1090, *E.*)

ACIDUM SULPHURICUM AROMATICUM, *E. D.*

PROCESS, *Edin. Dub.* Take of
Sulphuric acid of commerce three fluidounces and a half (half a pound, *D.*)
Rectified spirit a pint and a-half (two old wine pints, *D.*)
Cinnamon bruised an ounce and a-half.
Ginger bruised an ounce.
Add the acid gradually to the spirit, let the mixture digest at a very gentle heat for three days in a close vessel. Add the powders, digest for six days more and then strain (or the mixed powders may be moistened with a little of the acid spirit, and after twelve hours the powders may be exhausted by percolation with the rest of the spirit, *E.*)

UNGUENTUM ACIDI SULPHURICI, *D.*

PROCESS, *Dub.* Take of
Sulphuric acid one drachm,
Prepared axunge an ounce.
Mix them together.

FOR. NAMES. *Fr.* Acide Sulphurique.—*Ital.* Acido solforico.—*Ger.* Schwefelsäure.—*Dut.* Schwavelzuur.—*Russ.* Sernaia kislota.—*Pers.* Arekgowgird.—*Arab.* Roohazim.—*Tam.* Ghendaga Travagum.

SULPHURIC ACID, long termed vitriolic acid, and still in common

speech oil of vitriol, occurs in the free state in the neighbourhood of active volcanos, and in some mineral springs. It was known to the Arabian physicians and chemists.

Chemical History.—It exists in various states. When quite pure and free of water, it forms a tough crystalline solid, which melts at 66° into a mobile colourless liquid, boils at a temperature towards 122°, and fumes when exposed to the air.' It is composed of one equivalent of sulphur or 16.1 parts, and three equivalents of oxygen or 24 parts (SO^3). In this state it is seldom seen, being prepared merely for scientific purposes. The acid of commerce is materially different in appearance and properties. Two kinds are more or less in use in the arts. One, little known in this country, and commonly called Fuming, Glacial, or Nordhausen, sulphuric acid, is an oily-looking liquid of a brownish colour, and a density about 1900, fuming when exposed to the air, and yielding when gently heated in close vessels the anhydrous acid already described. This sort is largely prepared at a long established manufactory at Nordhausen, and is obtained by heating sulphate of iron to redness in a distilling apparatus. It sometimes contains a little sulphurous acid, but consists essentially, and according to some of the same equivalent proportions, of anhydrous acid and the other commercial variety of sulphuric acid, which is in the hydrated condition. The latter kind is known on the continent by the name of English sulphuric acid, to distinguish it from the acid of Nordhausen. It is the only kind in use in Britain, and as such will alone form the subject of the following observations.

Sulphuric acid is prepared in this country by subjecting sulphur and nitre together to strong heat along with a current of air, in consequence of which sulphurous acid and nitrous acid gas are disengaged. These are led into leaden chambers of great size, containing a thin stratum of water at the bottom. After a time the water becomes strongly charged with sulphuric acid, and being then withdrawn, the acid is concentrated by heating it strongly in glass retorts or platinum stills, so as to drive off most of the water. The nitrous acid in the first stage of this process serves a peculiar and essential purpose. It converts the sulphurous into sulphuric acid, itself becoming hyponitrous acid by deoxydation; the new acids immediately form with the watery vapour in the chamber a crystalline compound of water, hyponitrous acid and sulphuric acid; this compound falling into the water is at once decomposed, and sulphuric acid remains, while hyponitrous acid and deutoxide of nitrogen are disengaged, and at the same time combine in the air of the chamber with its oxygen to reproduce nitrous acid; and these chemical changes recur again and again, till the water is sufficiently loaded with sulphuric acid.

Commercial sulphuric acid thus prepared is a heavy, transparent, colourless, oily-like fluid, without odour or fumes, but of an overwhelming acrid acid taste. Its density varies between 1835 and 1840 or upwards; but when higher than 1845, this in-

dicates the presence of more than the usual amount of impurities. It freezes about 36° below zero, and boils a little above 600°. It is powerfully corrosive, speedily dissolving most animal or vegetable textures, and acquiring, as well as imparting to them, a deep black colour. Hence it ought not to be kept in bottles except with glass stoppers. It dissolves many of the metals in the cold if diluted, and others with the aid of heat if concentrated. When of the density 1845, it is a definite compound of one equivalent or nine parts of water, and one equivalent or 40.1 parts of anhydrous acid. It has a powerful affinity for water, so as to attract it quickly from the atmosphere, and also from many other bodies through the medium of the atmosphere, if confined together in a circumscribed space. Sulphuric acid and water unite in all possible proportions, with some condensation of volume and the evolution of much heat; and in consequence of impurities contained in the acid, nitrous fumes often escape, and a white muddiness arises. The heat thus produced is apt to crack glass vessels if not provided against; and with the proportions of 73 parts of acid and 27 of water it will raise the thermometer to 300° (Ure.)

When thus diluted with water sulphuric acid is in a more convenient state for dispensing as an internal remedy than in the concentrated form, and accordingly is admitted into all the Pharmacopœias. The proportion adopted by the London College is about one part of acid to five and a quarter of water by weight, and by the Dublin College one to seven, or very nearly the same with that of the Edinburgh College,—by which however the proportions have been given for convenience in measure. The density of the Edinburgh diluted acid is 1090. It is sometimes desirable to know the strength of sulphuric acid of various degrees of dilution; and Dr Ure has accordingly constructed a table, of which an abridgement is here given, and which states the percentage both of the anhydrous and hydrated acid according to the density of the mixture.

Hydr. Acid.	Dens.	Anhydr. Acid.	Hydr. Acid.	Dens.	Anhydr. Acid.	Hydr. Acid.	Dens.	Anhydr. Acid.
100	1848	81.54	66	1550	53.82	32	1233	26.09
98	1846	79.90	64	1528	52.18	30	1218	24.46
96	1841	78.28	62	1507	50.55	28	1203	22.83
94	1834	76.65	60	1486	48.92	26	1188	21.20
92	1823	75.02	58	1466	47.29	24	1171	19.57
90	1811	73.39	56	1446	45.66	22	1155	17.94
88	1796	71.75	54	1426	44.03	20	1141	16.31
86	1777	70.12	52	1407	42.40	18	1125	14.68
84	1757	68.49	50	1388	40.77	16	1109	13.05
82	1736	66.86	48	1370	39.14	14	1095	11.40
80	1712	65.23	46	1353	37.51	12	1081	9.78
78	1687	63.60	44	1334	35.88	10	1068	8.15
76	1663	61.97	42	1316	34.25	8	1054	6.52
74	1641	60.34	40	1300	32.61	6	1040	4.89
72	1620	58.71	38	1283	30.98	4	1027	3.26
70	1597	57.08	36	1265	29.35	2	1014	1.63
68	1576	55.45	34	1249	27.72	1	1007	0.81

As it is necessary for some purposes to have a sulphuric acid free of the ordinary impurities contained in the commercial sort, and more especially of nitrous acid, which is a common impregnation, the Edinburgh and Dublin Colleges have given directions by which this kind may be purified. The process of the Dublin College, which is a process of distillation merely, will not fully answer the end in view; for it will not certainly remove all the nitrous acid. Dilution with water, and subsequent concentration by heat, as recommended by some, will not fully effect the removal of the nitrous acid. Heating the sulphuric acid with sulphur, as proposed by Barruel, has the disadvantage of leaving a strong impregnation of sulphurous acid. But when a due proportion of sugar is substituted for the sulphur, according to the method of Wackenroder, adopted by the Edinburgh College, I find that the acid, which is first rendered black and opake, gradually becomes pale yellow if kept for two hours near its boiling point; that its colour becomes still paler on cooling; and that the nitrous acid entirely disappears, without any material impregnation of sulphurous acid being acquired. The proportion of sugar to be used can only be determined by trial on the small scale in each instance. The acids I have examined have required sometimes only eight grains, sometimes so much as fifteen grains, for every eight fluidounces. Sulphuric acid thus far purified will serve some purposes for which the commercial article is unfit, for example for preparing pure muriatic acid. But complete purification can only be accomplished by subsequently distilling it. This is usually considered a formidable operation with glass-vessels, on account of the risk of fracture, from the high temperature required, and the succussions of the boiling liquid; but it may be performed with ease and safety, if a few platinum chips be put into the retort, and the upper part be covered with an iron canopy, to keep it hot. The beak of the retort should be simply introduced into the receiver, without a connecting cork or lute; and upon the small scale a refrigeratory is not required. By the process now detailed a perfectly colourless acid is obtained, which is not at all acted on by protosulphate of iron, leaves no residuum when evaporated, and has but a faint sulphureous odour.

Adulterations.—Although commercial sulphuric acid is admitted by the Pharmacopœias as pure enough for medical use, and for most pharmaceutic purposes, it always contains some impurities, which must all be regarded more or less in the light of adulterations, and which render it unfit for certain processes in chemical pharmacy. At one time the chief impurity in the acid of this country was sulphate of lead, derived from the action of the acid on the lead of the chambers in which it is prepared. But much of what is now made in Britain is also impregnated with nitrous acid, probably on account of some peculiarities introduced of late years into the mode of manufacture.——The

London College limits the proportion of sulphate to two and a-half in the thousand. An excess above this limit indicates a very inferior article, and is most correctly ascertained by distilling the acid and weighing the residuum. But indeed the College has allowed the manufacturer too much latitude. For in three samples of sulphuric acid made by extensive manufacturers in Scotland, I have found only 0.62, 0.80, and 0.85 grain in one thousand grains. The sulphate of lead is always thrown down in a great measure by dilution with water, and is the cause of the muddiness which then arises.——The nitrous acid is also partly separated by dilution; which might therefore be employed as a test for its detection. But a much more delicate test of its presence is a solution of protosulphate of iron or of common green vitriol; which, when poured gently over the impure acid in a tube, immediately acquires a deep red colour at the line of contact from peroxidation of the iron by the nitrous acid, and communicates the same tint to the whole fluid upon agitation. This test, however, is to be used only in the case of an acid represented to be quite pure; because it is so delicate that the commercial acid will seldom resist it altogether.——An important adulteration, not uncommon on the continent, but scarcely known in this country except for a short time a few years ago, when manufacturers were led to use pyritic sulphur for making sulphuric acid, is arsenic. This substance, the presence of which in English acid was indicated not long ago by Dr Rees, may be easily detected by diluting the acid and passing through it a stream of sulphuretted-hydrogen; upon which a yellow sulphuret of arsenic is formed, as the London and Edinburgh Colleges have stated. It is stated to exist in the form of arsenic acid, and is left entirely in the retort when the sulphuric acid is carefully distilled. Sulphuretted-hydrogen is said not to remove it entirely from sulphuric acid, but this may be effectually done by an alkaline sulphuret [Dupasquier].——The presence of water in the commercial acid beyond what enters essentially into its constitution as a hydrate, is indicated by the density being under 1845.

Medicinal Properties.—Sulphuric acid is a powerful corrosive and irritant when concentrated or slightly diluted. It is consequently a most deadly poison. Its antidotes are chalk, magnesia, carbonate of magnesia, or the alkaline bicarbonates. The alkaline carbonates are objectionable as being themselves corrosive. Advantage has been taken of the corrosive action of sulphuric acid for effecting counter-irritation in some local diseases. An issue may be readily made with it in its concentrated state; but it is not an eligible article for the purpose, by reason of its liquidity. It is sometimes applied as a caustic to the skin of the eye-lid for curing inversion of the lid, and to the conjunctiva for curing eversion. When diluted with eight parts of lard, according to a formula in the Dublin Pharmacopœia, it produces redness or ulceration. An ointment of half that proportion was recommended by Dr Duncan,

Senior, for the cure of scabies; and when still weaker, it makes a good stimulant and rubefacient application in rheumatism and neuralgia.——In its diluted state sulphuric acid has been also sometimes used as a topical application, for example, in the treatment of indolent or foul ulcers of the throat and elsewhere; but other remedies of the same kind have displaced it for such purposes in the present day. Taken internally in this form it exerts a considerable variety of actions, being generally considered a refrigerant, astringent, tonic and diuretic, and having been likewise thought a powerful antiseptic when putrescency of the fluids had a place in pathological theories. Its most undoubted action is that of a refrigerant in hectic fever; and no remedy equals it in the property of abating or arresting the perspirations of hectic. This refrigerant property has also led to its use in continued fever; but here, as well as in exanthematic and some other allied febrile diseases, it is probably of little farther use than as a pleasant acid drink. Next in point of importance to its refrigerant property is its astringent action, as exerted in the arrestment of hemorrhages; in which respect however it is by no means so much to be relied on. As a tonic it has been employed in dyspepsia; but it is not much in use at present in that disease. The same property has obtained for it a place among remedies for diseases of debility at large. Its diuretic properties have perhaps not been so much studied as they ought to be: it sometimes succeeds in exciting diuresis in dropsical effusions where other powerful diuretics have failed. If used too long, it is apt to cause griping and diarrhœa.——When given as drink in fevers and the like, one or two drops of the concentrated acid may be added to eight ounces of water. Sugar, which is also added by some, makes a mixture which most fever patients speedily loathe. In all other cases where it is taken internally it is prescribed three or four times a-day in the form of the diluted acid, and in the dose of ten, fifteen, or twenty drops diluted farther with one or two ounces of water, and sweetened with a little sugar to take off the sharpness of its acid taste. Some use the aromatic sulphuric acid instead of the simple diluted acid. It should in general be sucked through a quill or glass tube to prevent the teeth being set on edge, or injured where it is long used.——Sulphuric acid is a useful addition to some laxative saline solutions, as will be found more particularly explained under the head of sulphate of magnesia. In the form of infusion of roses it is much used in the composition of mixtures.

Its preparations for external and internal use are as follows: *Acidum sulphuricum dilutum*, gutt. xv. *Acidum sulphuricum aromaticum*, E. D. gutt. xx. *Infusum rosæ gallicæ*, dr. iss. *Unguentum acidi sulphurici*, D.——It is employed in making a very great number of pharmaceutic preparations, which it is scarcely necessary to mention here.

ACIDUM TARTARICUM. *Tartaric acid.*

TESTS, *Edin.* When incinerated with the aid of red oxide of mercury, it leaves no residuum, or a mere trace only.

TESTS, *Lond.* Entirely soluble: its solution treated with any salt of potash deposites bitartrate of potash: the precipitate formed by acetate of lead is soluble in diluted nitric acid.

PROCESS, *Lond. Edin.* Take of
Bitartrate of potash, four pounds;
Boiling distilled water, two gallons and a-half;
Prepared chalk, twenty-five ounces and six drachms;
Diluted sulphuric acid, seven pints and seventeen fluidounces (ten pints and seven fluidounces, *E.*)
Muriatic acid, twenty-six fluidounces and a-half, or a sufficiency.
Boil the bitartrate with two gallons of the water, and add gradually half the chalk: when the effervescence is over, add a solution obtained by dissolving the rest of the chalk in the muriatic acid diluted with four pints of the water. After the tartrate of lime has subsided pour off the liquid, and wash the tartrate with distilled water till it is tasteless. Pour the sulphuric acid on the tartrate and boil for fifteen minutes. Evaporate with a gentle heat to obtain crystals. Purify by repeated solution, filtration, and crystallization.

PROCESS, *Dub.* The only differences in the Dublin process from that of the London College are that it directs the chalk to be added to the bitartrate to saturation, the muriate of lime to be added to the residual liquid in sufficient quantity, and not till the liquid has been separated by filtration and washing from the tartrate of lime formed in the first stage of the process, and the action of the sulphuric acid to be kept up at a gentle heat for three days, with frequent stirring.

FOR. NAMES.—*Fr.* Acide tartrique.—*Ital.* Acido tartrico.—*Ger.* Weinsteinsäure.—*Dut.* Wijnsteen zuur.—*Russ.* Vinnaia kislota.

TARTARIC ACID was first obtained in a state of purity by Scheele in 1769. It exists in many vegetable fluids, but especially in the juices of acid fruits. It abounds in grape-juice; and all the acid used in medicine and the arts is obtained from the crust formed from this juice in the course of the making and ripening of wine.

Chemical History.—The process for preparing tartaric acid is in many respects the same with that for preparing citric acid. The bitartrate of potash contains two equivalents of acid for one of base; and one of these equivalents may be separated in the form of tartrate of lime by adding the carbonate of that earth to the solution of the salt. The remaining equivalent of tartaric acid, which continues in combination with the potash, forming a neutral tartrate, is best detached in the state of tartrate of lime by double decomposition through means of a soluble salt of lime, such as the muriate. In order to obtain tartaric acid from tartrate of lime, this compound is decomposed by means of the superior affinity of sulphuric acid, and a solution of tartaric acid is thus formed, from which the acid is got in crystals by evaporation and cooling. The process of the Colleges is found to answer its purpose; but to ensure success certain precautions must be observed, which might have been specified with advantage. When the chalk is added to the bitartrate, it may be conveniently shaken through a sieve into the liquid, to prevent it from caking. In decomposing the tartrate of lime by sulphuric acid it is indispensable that the acid be in excess, but that the excess be slight. If the tartrate of lime be in excess the tartaric acid will not crystallize; and if the sulphuric acid be in

too great excess the liquor in the final evaporation is apt to become dark. According to Berzelius the most convenient proportion is 97½ parts of concentrated sulphuric acid for every 100 parts of chalk that have been used. After the decomposition of the tartrate of lime is completed the greater part of the sulphate of lime separates insoluble; but a part remains in solution till the acid liquor is concentrated to the consistence of a thin syrup or the density of 1200, when it separates almost entirely. At this stage of the evaporation therefore the liquor ought to be left some time at rest, and the deposit then poured off. The crystals of tartaric acid ultimately obtained, which are at first somewhat coloured, may be purified by repeated solution and recrystallization; but the process is facilitated by boiling the solution with a little vegetable charcoal, or, according to Geiger, by dropping nitric acid into the hot solution till the colour disappears. Several days should be allowed for each crystallization. The process is troublesome and uncertain except on the large scale.

Tartaric acid crystallizes in prisms, whose primitive form is the right rhombic prism, and which are permanent in the air. It is intensely acid to the taste, but without odour. It fuses at a moderate elevation of temperature; and considerably under a red heat it is decomposed, giving rise, among other products, to a new acid, the pyrotartaric. It is soluble in half its weight of boiling water, and in five times its weight at 60°. Its solution becomes mouldy by keeping. It is also soluble, though much more sparingly, in alcohol. The best character for distinguishing it from other acids, is the effect of a salt of potash, such as the muriate, on its solution: bitartrate of potash is formed; which, if the solution be not too diluted, separates in the form of a dusty precipitate immediately, or gradually in regular crystals. It consists of four equivalents of carbon, two of hydrogen and five of oxygen, united with one equivalent of water of crystallization ($C^4 H^2 O^5 + HO$.)

Adulterations.—The only adulteration prevalently met with in the tartaric acid of the shops is lime, which is indeed seldom entirely absent. It is best detected and its proportion estimated by incineration, as directed by the Edinburgh formula,—the lime being left in the form of carbonate. Good tartaric acid does not leave above a 2000th of its weight of carbonate of lime. In the system of tests given by the London College, the adulteration with lime, the only common impurity, is neglected. The effect of the salts of potash in separating from its solution a bitartrate of potash,—which the same College has annexed,—is a test of its nature, and not of its purity.——The adulterations of tartaric acid, so far as consists with my own observation, are unimportant; for the acid of commerce in this country never contains any impurity except an insignificant trace of lime.

Actions and Uses.—Tartaric acid is in large doses an irritant, but not a powerful one; and its activity as such is removed by

dilution. In small doses it is a refrigerant. But it is seldom put to any use in medical practice except for making acid drinks and effervescing powders; for which purposes however the consumption of it in Britain is very great. It constitutes the acid of the powders usually sold under the name of lemonade powders, which consist of tartaric acid, sugar, and a little essential oil of lemon, but never contain the citric acid as is often supposed. It also constitutes the acid of a common effervescing powder, sold under the name of "citrated kali," for making an agreeable beverage for general purposes as well as in sickness. This is composed, never of citric acid as its name would imply, but of tartaric acid and bicarbonate of potash. These powders become useless when long kept; for in the course of time the acid decomposes the carbonate and unites with its potash. For medicinal use it is more usual to keep the two ingredients for effervescing drinks distinct from one another, and to dissolve each in two or three ounces of water before mixing them. The carbonates of the alkalis are sometimes used in making these double powders; but the bicarbonates or sesquicarbonates should always be preferred, not merely because they cause more brisk effervescence, but likewise because little or no harm can accrue, as might happen in the case of the carbonates, if two powders of the alkaline salt be used by mistake, instead of one of each ingredient. The proper proportions will be seen under the head of *Sodæ carbonas.*

ACONITUM, *E.* ACONITI FOLIA, *L. D.* *Leaves of Aconitum Napellus, L. W. DC. Spr. (Edin.)—of Aconitum paniculatum, DC. (Lon. Dub.) Monkshood.*

ACONITI EXTRACTUM, E. L. ACONITI SUCCUS SPISSATUS, D.

PROCESS, *Edin.* Take of fresh leaves of monkshood any convenient quantity; beat them into a pulp; express the juice; subject the residue to percolation with rectified spirit, so long as the spirit passes materially coloured; unite the expressed juice and the spirituous infusion; filter; distil off the spirit; evaporate the residue in the vapour-bath, taking care to remove the vessel from the heat so soon as the due degree of consistence shall be attained.

PROCESS, *Lond. Dub.* Take a pound of fresh leaves of monkshood; bruise them in a stone mortar with a little water; express the juice; and without defecation, evaporate to the due consistence over the vapour-bath, with constant stirring.

ACONITI RADIX, *L.* *Root of Aconitum paniculatum, DC. Monkshood-root.*

ACONITINA, *L.* *Alkaloidal principle of the root of Aconitum paniculatum, DC. Aconitin, Aconita.*

TESTS, *Lond.* An alkali prepared from monkshood leaves or root; soluble readily in ether, less in alcohol, scarcely in water; entirely destructible by heat without any residuum of calcareous salt; endowed with virulent properties, and not to be rashly used.

PROCESS, *Lond.* Take of
Dry, bruised monkshood-root, two pounds;
Rectified spirit, three gallons;
Diluted sulphuric acid, solution of ammonia, and purified animal charcoal, a sufficiency.

Boil the root for an hour with a gallon of the spirit in a retort with a receiver. Pour off the liquor. Repeat this with another gallon of spirit; and again with the remaining gallon. Express the root; filter the united liquors, and distil off the spirit. Concentrate what remains to an extract. Dissolve this in water, filter the solution, and evaporate it to the consistence of syrup. Add as much sulphuric acid, diluted with distilled water as will dissolve the aconitina. Then drop in ammonia. Dissolve the precipitate in diluted sulphuric acid mixed with water; agitate the solution for fifteen minutes with animal charcoal; filter again; add again solution of ammonia, and wash and dry the aconitina which separates.

FOR. NAMES.—*Fren.* Napel; Aconit.—*Ital.* Napello.—*Span.* Napelo.—*Port.* Napello.—*Ger.* Eisenhut; Sturmhut.—*Dut.* Monnikskap.—*Dan.* Druemunke. —*Swed.* Stormhatt.—*Russ.* Borets.

FIGURES of Aconitum Napellus in Hayne, xii. 12.—Nees von E. Supp. 109. —Roque, 129.—Steph. and Ch. i. 28.—Eng. Bot. 2720.

FIGURES of Aconitum paniculatum as Aconitum cammarum in Roque, 130.— Hayne, xii. 15.—As Aconitum Stoerckianum in Nees von E. Suppl. 111.

MONKSHOOD, long a familiar poison, was not used in medicine till Störck recommended it in 1762. The Ακονιτον of the Greeks comprised several plants, but not the modern aconite.

Natural History.—Doubts are entertained as to the species employed by Störck. The question, though not easily settled on account of the difficulty of defining the several species of the genus, is nevertheless important, because few have observed the virtues ascribed by Störck to his plant, while various species and subspecies have been used as the true one. Till a recent date the British Pharmacopœias agreed in assigning the medicinal monkshood to Linnæus's species *A. Napellus*,—a species which has been unnecessarily subdivided by his successors, with the effect of confusing the herbalist and medical botanist. But in recent times German authors more generally refer the plant to Linnæus's *A. Cammarum,* or rather to a particular variety of that species called by Sprengel *A. Stoerckianum,* and by Willdenow *A. neomontanum.* With this variety may be arranged as identical, or at least very similar, the *A. paniculatum* of Lamarc and Decandolle; which the latter botanist considers, and the London and Dublin Colleges on his authority have adopted, as the true aconite of Störck. It seems doubtful whether any of these corrections is exact. Störck's figure indeed of his *A. Napellus* resembles that species less than it does *A. neomontanum* or *paniculatum.* But he insists on strong acridity of the leaves as an essential character of his plant,—a property which is undoubtedly possessed by the true *A. Napellus;* whereas Geiger found the *A. neomontanum* to be scarcely acrid, and the leaves of *A. paniculatum*, raised in our Botanic Garden from seeds sent by Decandolle himself, are not at all acrid in any stage of its growth. It is certain at all events that the reference to *A. paniculatum* is erroneous; for I have ascertained that the leaves of this species cultivated at Edinburgh are inert, and Dr Alexander Fleming has found that even the root is simi-

larly circumstanced. Contrary to the opinion expressed in the former edition of this work, it has been rendered highly probable by the researches of Dr Fleming, that the very peculiar acrimony of the monkshoods is a measure of their narcotic properties, and consequently of their medicinal virtues. I have found that *A. Napellus, Sinense, Tauricum, uncinatum,* and *ferox* possess intense acrimony; that *A. Schleicheri* and *nasutum* possess it feebly; *A. neomontanum* very feebly; and that *A. paniculatum, lasiostomum, Vulparia, variegatum, nitidum, Pyrenaïcum,* and *ochroleucum* do not possess it at all. These facts will direct the medical botanist in the choice of a species for medicinal use, and show that the old reference of the Pharmacopœias to *Aconitum Napellus* is correct.

The *Aconitum Napellus,* so named from its somewhat turnip-shaped root, is a common inhabitant of wooded hills in most parts of the continent of Europe. It also grows freely throughout Britain in some wild localities, to which however it is generally believed to have strayed from gardens. It belongs to Linnæus' class and order, *Polyandria Trigynia,* and is one of the Family *Ranunculaceæ* in most natural classifications. It is easily known by producing a long dense spike of beautiful, deep-blue, helmeted flowers. Its stature is between two and four feet in the wild state, but often reaches six feet in gardens. The root, one of the officinal parts of the plant, consists of numerous slender radicles proceeding from a long tap-shaped root-stock, like the navew or French turnip in form, and brownish-black externally. It is formed during the summer and autumn as a tuber from the side of the old root-stock, which then decays; and the new one is in perfection for medicinal use from the close of autumn till the commencement of spring, when it begins to push up the new plant for the approaching summer. The leaves, also officinal, are palmated, with deep clefts and deeply-incised pinnatifid lobes. This species is easily distinguished from *A. paniculatum* by the flowers being deeper blue, presenting a less elevated helmet, and being arranged, not in a loose panicle, but closely appressed and crowded on the stem. The root too of *A. paniculatum* is not tap-shaped, but forms a small, irregularly-roundish root-stock. Neither the root nor the leaf of *A. Napellus* has any odour; but when chewed, they slowly occasion a singular sense of tingling and numbness in the lips, cheeks, and tongue. This property is possessed by the leaves from their first appearance till the seeds begin to form. But, as Geiger first remarked, and as I have often since observed, it afterwards quickly disappears; and when the seeds are ripe, it is entirely lost, though the leaves become even more vigorous than before. The ripe seeds themselves are intensely acrid. It is stated by Geiger that some acrid varieties of monkshood lose their acridity by cultivation. Such is certainly not the case with the variety of *A. Napellus* cultivated in the gardens and shrubberies of

Scotland. The leaves of *A. paniculatum* are bland throughout every period of their growth; and so are its seeds, and its root.

Chemical History.—The leaves and root of monkshood retain their acrimony and narcotic virtues when dried. Their acridity is little diminished when they are dried in the vapour-bath; and I have a specimen dried spontaneously ten years ago which still tastes as acrid as ever, if it be very carefully chewed. The expressed juice possesses the properties of the plant. The acridity exists there feebly, and is imperfectly removed from the pulp by expression, either with or without maceration in water; but rectified spirit removes it readily by the process of percolation. Hence it may be understood why the spirituous extract is strongly, but the aqueous extract scarcely, acrid. The narcotic properties of the plant are possessed energetically by the expressed juice and by the alcoholic extract of the leaves: But the watery extract is a precarious and irregular preparation; which ought to be abandoned, after the proofs given by Orfila of its irregularity and general feebleness, and after the chemical researches of Geiger, as well as the medicinal trials of Lombard, showing the great superiority of the extract prepared with rectified spirit. In preparing the alcoholic extract of the Edinburgh Pharmacopœia, a vapour-bath heat should alone be used; and the concentration must be stopped as soon as the proper consistence is attained and the odour begins to change, otherwise decomposition speedily commences, and a comparatively inert extract is the result. The facts mentioned in the present paragraph, which I have ascertained with some care, may account in part for the discrepant statements of authors respecting the medicinal virtues of monkshood. It is probable that a good narcotic extract may also be prepared by evaporating the expressed juice spontaneously, or in vacuo.

Monkshood owes its virtues to a peculiar alkaloid of intense activity. A narcotic principle was first doubtfully indicated by Pelletier and Caventou, and afterwards by Brandes; but it was probably first obtained pure by Geiger and Hesse in 1833; of whose process that adopted by the London College seems a modification. The substance eventually obtained, which is termed Aconita or Aconitina, is a white powder, permanent in the air, without odour, of a bitter taste, and acrid like the plant, uncrystallizable, easily fusible, not volatile, very soluble in alcohol or ether, and insoluble in water. Its solutions act like the alkalis on litmus, and neutralize the acids, forming uncrystallizable salts. It contains azote, like the other alkaloids, but has not yet been carefully analysed. A separate acrid principle, though indicated in monkshood by Geiger, has not yet been detected, and probably does not exist.

Actions and Uses.—Monkshood was admitted into the Pharmacopœias chiefly in consequence of the high encomiums bestowed on it by Störck as an anodyne in neuralgia and a deobstruent in glandular diseases. It is an energetic poison. Both the root and leaves

occasion a singular tingling and numbness of the mouth, and in large doses symptoms of irritation of the stomach, which are soon masked however by loss of common sensation and paralysis of the whole voluntary muscles, but without coma or convulsions; and death takes place from paralysis of the muscles of respiration. Thirty grains of the alcoholic extract of the leaves will kill a rabbit in two hours, if its aqueous solution be injected into the cellular tissue beneath the skin. The source of these narcotic properties is the alkaloid, aconita; which is so subtile a poison that a fiftieth of a grain will kill a sparrow in a few minutes (Geiger.) There is no antidote yet known for poisoning with monkshood.——Doubts have prevailed as to its actions in medicinal doses. By Störck and his followers it was considered an anodyne, calmative and antispasmodic, a stimulant of the absorbents, a diuretic and diaphoretic. In more recent times few of these effects have been obtained from it. But M. Lombard of Geneva lately revived it as an anodyne and sedative antiphlogistic; and the subsequent investigations of Dr Fleming and others have confirmed and extended his results. Lombard found an alcoholic extract of the leaves to exert marked effects as an anodyne and antiphlogistic in acute rheumatism and in other acute local inflammations. Under doses varying from half a grain to eight grains every two, four, or six hours, the severest attacks of febrile rheumatism yielded in the course of two, four, or six days; and even protracted cases of subacute rheumatism were often cured. The relief of pain and abatement of fever commenced in a few hours, without any critical evacuation by the skin, bowels, or kidnies. Dr Fleming, who used a very strong tincture, prepared by passing twenty-four fluidounces of rectified spirit through sixteen Troy ounces of powdered root, found that this preparation, in the dose of three or five minims every four or eight hours, is a serviceable anodyne, calmative, and antiphlogistic in the various forms of neuralgia and chronic rheumatism, and in diseases of the heart, whether functional or organic. No one has been of late able to observe the diaphoretic and sudorific properties ascribed to monkshood by Störck. His opinion of its deobstruent virtues, which led to the current employment of it in diseased mesenteric glands, external scrofulous tumours, scirrhus, and enlargement of the liver, is now discredited. And the diuretic virtues claimed for it by him in dropsy have not been noticed by any other physician of the present day except Fouquier. On account of its dangerous properties as a poison, monkshood must be given with caution; but there is no ground for the extravagant fears entertained of it by some, in consequence of a few fatal accidents from the indiscreet use of it before its actions and energy were well understood. The larger medicinal doses excite nausea, numbness and tingling in the lips and cheeks, or even over the chest and other parts of the body, diminution of the force and frequency of the pulse, which sometimes sinks to 40, great muscular weakness, and confusion and

dimness of sight. If the doses be diminished when these effects arise, and stimulants given when they increase, there is no reason for alarm. In one or two instances I have found it impossible to persevere on account of frequent vomiting and diarrhœa.

The alkaloid aconita has been employed as an external remedy for neuralgia. An ointment of twenty grains to half an ounce of axunge has been represented to act serviceably in tic douloureux, sciatica, and other neuralgic diseases, when rubbed over the affected part. The experience of the profession however upon this subject is far from having been such as to warrant its admission into the Pharmacopœias. The London College has alone adopted it.

It was observed above, that various species and subspecies of aconite possess the same narcotic qualities with the *A. Napellus.* But none of them equals in energy the *A. ferox* of the East Indies, the root of which is prevalently used there as an energetic poison under the name of Bikh or Nabee. The tingling of the lips and tongue produced by tasting this root is most intense. Dr Pereira found that one or two grains of its alcoholic extract will kill a small animal in ten or fifteen minutes if introduced into the cellular tissue beneath the skin.

The only officinal preparation of monkshood, with its doses, is *Aconiti extractum*, E. L. *Aconiti succus spissatus*, D. gr. i. ad gr. viii. repeatedly. The dose of Dr Fleming's tincture is m. iii. to m. viii. It is inconveniently strong, and would be better if diluted with twice its volume of spirit.

ACORUS. See *Calamus.*

ADEPS, *L. D.* See *Axungia* and *Sevum.*

AERUGO, *E. L.* See *Cupri Acetas.*

AETHER NITROSUS, *D.* *Hyponitrous ether.* *Nitric ether.*

PROCESS, *D.* Take of
Purified Nitrate of potash in coarse powder, one pound and a-half;
Sulphuric acid, a pound;
Rectified spirit of wine, nineteen ounces by measure.

Put the nitrate into a tubulated retort in a cold water-bath. Add gradually and successively the acid and spirit previously mixed and cooled. An ethereal liquid will rise without heat, or on adding tepid water to the bath. Brisk ebullition, which soon follows, must be kept down by substituting cold water. The receiver, which should be cooled by water or snow, must have an apparatus for transmitting the elastic vapour, sometimes suddenly disengaged, through a pound of rectified spirit kept cool in a bottle. Put now the distilled liquid into a bottle with a ground-glass stopper, and add gradually dry carbonate of potash, till the liquid ceases to redden litmus; for which one drachm is commonly required. The nitrous ether, which soon floats on the top, is then to be separated by a funnel. It may be obtained very pure, if necessary, by distilling off one-half from a water-bath at 140°. Its density is 900.

SPIRITUS AETHERIS NITRICI, *E. L.* SPIRITUS

AETHERIUS NITROSUS, *D.* *Hyponitrous ether, with (four volumes of, E.) rectified spirit.* *Spirit of nitric ether.*

Tests, *Edin.* Density 847. It effervesces feebly or not at all with solution of bicarbonate of potash. When agitated with twice its volume of concentrated solution of muriate of lime, twelve per cent of ether slowly separate.

Tests, *Lond.* Density 834. It slightly reddens litmus, and does not effervesce with carbonate of soda. It possesses a characteristic odour.

Process, *Edin.* Take of
Rectified-spirit two pints and six fluidounces;
Pure nitric acid (D. 1500), seven fluidounces;
Put fifteen fluidounces of the spirit, with a little clean sand, into a two-pint mattrass, fitted with a cork, through which are passed a safety-tube terminating an inch above the spirit, and another tube leading to a refrigeratory. The safety-tube being filled with pure nitric acid, add through it gradually three fluidounces and a-half of the acid. When the ebullition, which slowly arises, is nearly over, add the rest of the acid gradually, half a fluidounce at a time, waiting till the ebullition caused by each portion is nearly over before adding more, and cooling the refrigeratory with a stream of water, iced in summer. The ether thus distilled over being received into a bottle, it is to be agitated, first with a little milk of lime till it ceases to redden litmus-paper, and then with half its volume of a concentrated solution of muriate of lime. The pure hyponitrous ether thus obtained, which should have a density of 899, is then to be mixed with the remainder of the rectified spirit, or exactly four times its volume.
Spirit of nitric ether ought not to be kept long, as it always undergoes decomposition, and becomes at length strongly acid. Its density by this process is 847.

Process, *Lond.* Take of
Rectified-spirit, three pounds;
Nitric acid, four ounces;
Add the acid gradually to the spirit and mix them; then distil thirty-two fluidounces.

Process, *Dub.* Add to the residuum of the distillation of nitrous ether the spirit employed in that process for condensing the elastic vapours, and distil with a vapour-bath heat to dryness. Mix the distilled liquor with the alkaline liquor remaining after separation of the nitrous ether, and add dry carbonate of potash till the liquor ceases to redden litmus. Lastly distil with the vapour-bath heat so long as any thing passes over. The density of the liquid is 850.

For. Names.—*Aether Nitrosus.* *Fren.* Ether nitreux.—*Ital.* Etere nitrico.—*Ger.* Salpeternaphtha.
Spiritus Etheris nitrici. *Fren.* Alcool nitrique.—*Ital.* Etere nitrico alcoolizzato.—*Ger.* Salpeternaphtha-weingeist.

Nitric, Nitrous, or Hyponitrous ether was first prepared in 1681 by Kunkel; but in the form of spirit of nitric ether it was known so early as the thirteenth century to Reymund Lully (Geiger).

A great variety of processes have been suggested for obtaining pure hyponitrous ether. The chief difficulty to be kept in view is the risk of violent action and dangerous explosions, especially when operations are conducted on a considerable scale. Some, to avoid this risk, use diluted nitric acid; others pour a layer of water over the acid, and the spirit over the water, and allow the action to take place very slowly; others again bring the spirit in contact with the acid at the moment of its disengagement from the action of sulphuric acid upon nitre. It is surprising however with what safety and despatch the process may be conducted by direct action of the strong acid on the spirit, provided certain little precautions be attended to, such as are detailed in the first part of the formula of the Edinburgh College for making spirit of nitrous ether. I have repeatedly made nitrous ether by that formula, and have never ex-

perienced any risk of explosion or over-violent action. Should the ebullition show any tendency to become tumultuous, it may be subdued at once by simply blowing cool air across the mattrass. The presence of the sand in the mattrass, and the position of the extremity of the safety tube, are essential precautions, without which the liberation of the ether is attended with dangerous succussions or violent ebullition. Instead of the strong nitric acid of the formula, the commercial acid of density 1380 may be used in the proportion of nine fluidounces (Maclagan).——In this and every other process the ether which distils over is accompanied with some water, some undecomposed alcohol, and a little acid. The acid is removed in the Edinburgh process by milk of lime, and the water and alcohol by a concentrated solution of chloride of calcium; upon which a very pure ether separates and floats on the saline solution.——The process of the Dublin College, in which the spirit is presented to the nitric acid while the acid is in the act of being formed, does not differ in principle from the Edinburgh process; but it appears less convenient and does not so easily furnish so pure an ether.

The Spirit of nitric ether (Spirit of nitrous ether; Sweet spirit of nitre; Ethereal nitric spirit) may be obtained directly, according to the London formula, by distilling nitric acid with a much larger proportion of spirit than is required for obtaining nitrous ether, or more indirectly by using the residuum of the distillation of ether, as the Dublin College has enjoined. But when so simple and safe a process as that of the Edinburgh College may be resorted to for preparing pure nitrous ether, it seems advisable to secure uniformity, as that College has done, by making the ethereal spirit from the ether by mere dilution with the due quantity of rectified spirit. The degree of dilution has been fixed so as to render the ethereal strength of the preparation as nearly as possible the same with that of the Pharmacopœia of 1817. That is, the ether constitutes one-fifth of the volume of the ethereal nitric spirit. This, it must be observed, is at least twice, perhaps even thrice, as strong as the London preparation. The London process appears objectionable, inasmuch as only a small proportion of the spirit is converted into ether.

The chemical actions which take place in the preparation of nitrous ether are complicated and not very easily made intelligible. A great variety of products result besides ether, such as water,—nitrous oxide gas, and nitric oxide gas, which pass over with it,—and oxalic, malic, acetic, formic, and hydrocyanic acids, which are found in the residuum. But the reaction which gives rise to the formation of nitrous ether seems to consist essentially in the alcohol being deprived of an equivalent of oxygen and hydrogen so as to pass to the state of true ether, in the nitric acid parting with two equivalents of its oxygen so as to become hyponitrous acid, and in the hyponitrous acid and ether uniting to form hyponitrous ether

Nitrous, or rather hyponitrous, ether is a pale-yellow very mobile fluid, of a penetrating peculiar odour like that of apples, and of a sweetish, cooling, sharp taste. Its density has been variously stated between 886 at 40° (Dumas) and 909° at 60° (Meissner). As prepared by the process of the Edinburgh Pharmacopœia it is 899° at 60°. It is very volatile, so as to boil even at 70°. It is also highly inflammable. When recently made it does not redden litmus, but does so strongly in no long time in consequence of undergoing decomposition. The nature of the changes it undergoes, and the circumstances which regulate them, are not satisfactorily known. But no method has yet been contrived for preventing its decomposition; and it is well known that in the course of its alteration nitrous acid is gradually and at length abundantly formed. It is dissolved in all proportions by alcohol or rectified spirit. It is soluble according to Berzelius in forty-eight parts of water. The alkalis decompose it, forming alkaline nitrates and acetates, alcohol, and various gases. Different views have been taken of its constitution. The most generally received theory considers it a compound of one equivalent of true ether, and one equivalent of hyponitrous acid ($C^4 H^5 O + NO^3$); but it may be also viewed as a compound of one equivalent each of hyponitrous acid, etherine, and water ($NO^3 + H^4 C^4 + HO$).

The spirit of nitric ether is, according to its strength, either colourless or of the lightest straw colour. The London spirit is colourless; that of Edinburgh very pale yellow. Its odour and taste are the same with those of hyponitrous ether, but not so strong. When recently prepared it is not acid; but it gradually becomes so when kept. This change seems to take place most quickly in the strongest qualities of it, more quickly according to Geiger in that which is made by direct distillation than in what is prepared by diluting hyponitrous ether with rectified spirit, and, according to my observations, more quickly in the latter variety than where the diluting liquid is absolute alcohol. Some specimens of the London preparation, which I found to keep remarkably well, contained extremely little ether. Spirit of nitric ether is less volatile than hyponitrous ether. Its density is lower, and varies with its strength, the stronger being the denser. It is much more soluble in water, so that the two fluids combine in any proportion. The strength of what is met with in the shops varies exceedingly, —that of the London spirit being 834, and that of the Edinburgh preparation 847. The strength is best judged of by agitating the spirit with twice its volume of concentrated solution of muriate of lime, upon which a considerable proportion of the ether rises to the surface. The Edinburgh preparation gives twelve per cent of ether when so treated; that made by the London formula never yields more than four, and sometimes none.

Adulterations.—Spirit of nitric ether, the only preparation of hyponitrous ether to be found in the shops, is exceedingly subject

to adulteration, partly from faults in preparing it, partly from the cupidity of fraudulent dealers. It is avowedly sold to retailers at prices of which the highest is nearly thrice the lowest. The impurities are nitrous acid, from its being too long kept, and water or alcohol or both, which are fraudulently added. Acidity is detected by the spirit effervescing sensibly with carbonate of soda or bicarbonate of potash. Water and alcohol are best discovered by agitation with muriate of lime, as explained above. The density, the only character given by the London College for these adulterations, is scarcely sufficient; for it does not exclude the presence of an undue proportion of watery spirit.

Actions and Uses.—Spirit of nitric ether is a powerful stimulant and antispasmodic, a diaphoretic, and a diuretic. As an antispasmodic stimulant it closely resembles sulphuric ether, and is employed for the same purposes with that substance. But it is less energetic and not so much in use. Its diaphoretic virtues are not so well marked; but it is employed by some on account of this action, along with other diaphoretics, in debilitated and typhoid states of the system. Its most important property in a therapeutic point of view is that of exciting the kidnies to increased secretion. It frequently fails to act when given for this purpose, from the extent to which the remedy is adulterated, together with the substitution, even in the best druggists' shops, of the weaker London preparation for that formerly in use in this part of the country. But at the same time I confess I have not found it by any means so certain a diuretic as it is held to be, even making allowance for the possibility of an inferior article being prevalently used. It has appeared to me least serviceable in dropsy connected with diseased kidney, and most useful in the form associated with diseased heart. It may be advantageously combined as a diuretic in dropsy either with syrup of squills, acetate of potash, or bicarbonate of potash. It is useful in strangury, and is a good addition to copaiva, both as aiding to convert it into the form of mixture, and as a diuretic for diluting the acrimony of the urine when copaiva is given in diseases of the bladder or urethra. Some use it in gravel, simply as a diuretic, for increasing the urine, the natural solvent of gravelly deposits. Spirit of nitric ether is a narcotic poison. The accidental inhalation of its vapour during sleep has occasioned even death; and little doubt can exist that the same result might arise from an overdose taken into the stomach. Sometimes medicinal doses excite pain in the stomach and griping, an effect which probably depends on the preparation being too old and consequently loaded with nitrous acid.

The usual dose of *Spiritus ætheris nitrici*, either as a stimulant or as a diuretic, is from half a drachm to two drachms several times a-day. It is probably best given merely in water. A formula for giving it with copaiva will be found under that article.

AETHER SULPHURICUS, *E. L. D.* *Sulphuric ether.*

Tests, *Edin.* Density 735 or under: when agitated in a minim measure with half its volume of concentrated solution of muriate of lime its volume is not lessened.
Tests, *Lond.* Density 750; but that of commercial ether varies from 733 to 765; entirely vaporizable; slightly reddens litmus: unites sparingly with water, namely in the proportion of a fluidounce to half a pint, and continues limpid.

Process, *Edin.* Take of
Sulphuric acid, ten fluidounces,
Rectified spirit, fifty fluidounces:
Pour twelve fluidounces of the spirit gently over the acid in an open vessel, and then stir them briskly and thoroughly: transfer the mixture immediately into a glass mattrass connected with a refrigeratory, and raise the heat quickly to about 280°. As soon as the ethereal fluid begins to pass over, supply fresh spirit through a tube into the mattrass in a continuous stream, and in such quantity as to equal the volume of the fluid which distils over. This is best done by connecting one end of the tube with a graduated vessel containing the spirit,—passing the other end through a cork fitted into the mattrass,—and having a stopcock on the tube to regulate the discharge. When the whole spirit has been added, and forty-two fluidounces have distilled over, the process may be stopped. Agitate the impure ether with sixteen fluidounces of a saturated solution of muriate of lime, containing also half an ounce of lime recently slaked. When all odour of sulphurous acid has disappeared, pour off the supernatant liquid, and distil it with a gentle heat so long as what passes over has a density not higher than 735. More ether of equal strength may be obtained from the muriate of lime. And from the residuum of each distillation a weaker ether may be obtained in small quantity, which must be rectified by distilling it gently again.

Process, *Lond.* Take of
Rectified spirit, three pounds;
Sulphuric acid, two pounds;
Carbonate of potash recently ignited, an ounce.
Pour two pounds of spirit into a glass retort, add the acid, and mix them. Place the retort in a sandbath, and make the liquid begin to boil as quickly as possible, receiving the ether in a vessel cooled by ice or water. Continue the distillation till a heavier liquid begins to pass over. To the residuum in the retort, previously cooled, add the rest of the spirit, and distil as before. Add the distilled liquids, pour off the supernatant part, add to this the carbonate of potass, and shake occasionally. Then distil the ether from a large retort, and preserve it in a well-corked vessel.

Process, *Dub.* Take twenty ounces by measure of Sulphuric ethereal liquor, and two drachms of dry powder of Carbonate of potash: mix and distil with a gentle heat twelve ounces by measure from a very high retort into a cooled receiver. Density of the ether 765.

Spiritus Aetheris Sulphurici, E. L.

Tests, *Edin.* Density 809. It does not affect litmus-paper, or render water muddy: when agitated with twice its volume of concentrated solution of muriate of lime, 28 per cent of ether separate by rest.

Process, *Edin. Lond.* Take of
Sulphuric ether, a pint;
Rectified spirit, two pints.
Mix them together.

Spiritus Aetheris Sulphurici Compositus, L.

Process, *Lond.* Take of
Sulphuric ether, eight fluidounces;
Rectified spirit, sixteen fluidounces;
Ethereal oil, three fluidrachms.
Mix them together.

LIQUOR AETHEREUS SULPHURICUS, *D.* *Impure sulphuric ether, containing spirit, and generally ethereal oil.*

Process, *Dub.* Take of
Rectified spirit and sulphuric acid, thirty-two ounces; put the spirit into a retort that will stand sudden heat; pour in the acid in a steady stream; mix gradually and distil with a quickly-raised heat twenty ounces by measure. More sulphuric ethereal liquor will be obtained on adding sixteen ounces of rectified spirit to the residuum in the retort and resuming the distillation.

OLEUM AETHEREUM, *L.* *Probably a compound of sulphuric acid and sulphuric ether.*

PROCESS, *Lond.* Take of
Rectified spirit, two pounds;
Sulphuric acid, four pounds;
Solution of potash and
Distilled water, of each a fluidounce, or a sufficiency.
Mix the acid cautiously with the spirit; distil till a black froth rises, and instantly remove the retort. Separate the light fluid from the heavier and expose it for a day to the air. Agitate with it the solution of potash previously mixed with the water, then separate the ethereal oil which subsides, and wash it well.

FOR. NAMES.—*Aether sulphuricus.*—*Fren.* Ether sulphurique.—*Ital.* Etere solforico.—*Ger.* Aether; Schwefeläther.—*Russ.* Sernœ æphir.

SULPHURIC ETHER has been known for some centuries, having been described in 1540 by Valerius Cordus.

Chemical History.—It is obtained by the action of sulphuric acid upon alcohol in various degrees of concentration, but best of all by the action of concentrated sulphuric acid upon rectified spirit. The conditions for complete success are rather precise, and will best appear on considering the theory of the formation of ether.

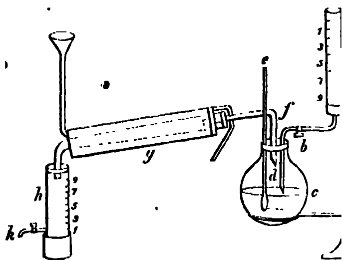
The theory of etherification was long a matter of uncertainty, but since the investigations of Mr Hennell and others it is better understood. Among the various views lately taken of it, the following is most generally received. Alcohol in its pure state may be considered a compound of ether and water. This will be apparent on attending to its elementary composition, which is 4 equivalents of carbon, 6 of hydrogen, and 2 of oxygen, and is represented by the formula $C^4 H^6 O^2 = C^4 H^5 O + H O$, the formula for 1 Ether +1 Water. If we can therefore separate in any way the equivalent of water, ether will be formed; and it may in point of fact be thus simply formed from pure alcohol by means of fluoboric acid gas. In the case of sulphuric acid the process is more complex. An intermediate change occurs, in consequence of which water is formed, and a peculiar acid, the sulphovinic or etherosulphuric acid,—a compound of 1 ether and 2 anhydrous sulphuric acid [$C^4 H^5 O + 2 S O^3$]. This acid is at once formed when alcohol, especially in its diluted form of rectified spirit, is brought in contact with sulphuric acid; and from such a mixture it may be detached by bases in the form of definite salts or etherosulphates. But at an elevated temperature a farther change ensues. The etherosulphuric acid is in its turn decomposed; ether is disengaged; while the anhydrous sulphuric acid unites with the water formed during the preliminary decomposition of the alcohol, with its own original water of composition, and with the water of the decomposed rectified spirit. That etherosulphuric acid is thus decomposed has been proved by its gradually diminishing in the mixture according as ether distils over. If the water disengaged during these changes remained all behind with the sulphuric acid, the process of etherification would soon cease; for the sulphuric acid would at length become too diluted to convert the alcohol into etherosulphuric acid. The process however is kept up,—first, because sulphuric acid re-

tains the property in question even when diluted with half its weight of water,—and secondly, because sulphuric acid diluted to this degree boils and gives off its water nearly at the temperature at which etherosulphuric acid gives off its ether; and consequently a portion of water, amounting to about a fourth part of the ether, distils over along with that fluid.

From these considerations it ought to follow according to theory, that the same sulphuric acid will serve for the complete etherification of any conceivable quantity of alcohol supplied continuously as the ether passes off. But certain practical difficulties prevent this theoretical deduction from being realized. On the one hand a proportion of the alcohol invariably escapes decomposition and is carried in a state of vapour with the ether into the refrigeratory; and the proportion is greatly increased if the spirit be too liberally supplied, or if the heat be allowed to fall under a certain point; for at a temperature, little short of that at which etherosulphuric acid gives off ether, a different set of chemical actions is established,—the ether uniting with an equivalent of water to reproduce alcohol, and the alcohol rising in vapour to pass over into the refrigeratory. On the other hand, if the spirit be not supplied in sufficient proportion, so that the sulphuric acid at length preponderates,—and likewise probably if too much water escape with the ether, or too strong a spirit be supplied, so that the anhydrous sulphuric acid cannot find water enough to pass into its customary hydrated condition,—a farther decomposition takes place, in consequence of which a resinous matter containing much carbon is separated and blackens the liquid, while the sulphuric acid also undergoes decomposition, and sulphurous acid gas is disengaged along with the ether. Various accounts have been given of the extent to which the process may be advantageously continued with the same sulphuric acid before being brought to a close by these obstructions. The Parisian Codex of 1837 states, that the process may be stopped when the rectified spirit amounts to twice the weight of the acid; and that the product in impure ether should amount to three-fourths of the whole spirit used. Liebig however mentions, that four times the weight of the acid may be advantageously supplied; and that one hundred parts of rectified spirit which disappear yield 59 or 60 of purified ether of the density 725 at 60° [Handwörterbuch, i. 110]. Sottmann says that ten, and Dr Fownes that twenty times the weight of the acid may be used; and Geiger has alleged that the process, when well managed, may be continued with the same acid indefinitely, so as to produce nothing but ether and water [Handbuch, i. 711].

I have been thus particular in describing the theory of etherification, because it forms the basis of a process currently practised on the continent, which is superior in facility and productiveness to the older method commonly pursued in Britain, and recommended in the English and Irish Pharmacopœias. This process, first pro-

posed by Boullay, is fully detailed in the instructions given by the Edinburgh College. It is easily managed on the small scale with an apparatus of the following construction. *a*, a graduated tube to supply and measure the spirit; which passes by the tube and stopcock, *b*, to the surface of the fluid in the mattrass, *c*.—*d* the oblique end of the exit-tube *f*, which terminates in the refrigeratory, *g*, described more particularly in the Introduction.



—*h*, a graduated vessel to receive and measure the distilled liquid; which, when the measure is full, may be withdrawn by the stopcock, *k*.—*e*, a thermometer capable of ascending to 340°. The point of the supply-tube may either touch or dip into the liquid. The mode of mixing the acid and spirit advised in the Edinburgh process is perfectly safe; but a transient burst of effervescence which occurs at the commencement might render it unsafe in a deep vessel or in a mattrass. The heat occasioned by the mixture, which attains a temperature of 210° or upwards, should be promptly taken advantage of, and raised to 280°, where it should be steadily maintained at first. Dr Fownes however applied at once a temperature of 300° to 360°, although he thinks a lower heat, between 280° and 290°, is sufficient if the ebullition be brisk. No method of heating answers so well on the small scale as by means of a gas rose-burner. The method advised by the Edinburgh College for purifying the raw ether by solution of muriate of lime and slaked lime, the latter of which removes sulphurous acid and the former alcohol and water, is convenient and perfect. It effects its purpose at once; and the muriate may be recovered by concentrating the solution after a little ether and alcohol have been got from it, filtering it while hot, and separating the crystals of sulphite of lime which form on cooling. By this process I have obtained on the small scale results nearly as favourable as those of Liebig. From fifty-four fluidounces of rectified spirit of density 845 there were produced twenty fluidounces and a-half of ether of the density 732; and ten fluidounces and a-half of spirit of 845 were recovered from the the residuums. This exceeds by nearly ten per cent the result of the old process even when conducted on the large scale (Brande).

According to the older method still practised in Britain, and well explained in the formula of the London College, the sulphuric acid is first mixed with its own weight of spirit; and when a certain quantity of ethereal liquid has distilled over, half the original quantity of spirit is added and the distillation resumed. The resulting liquid is then freed of sulphurous acid by agitation with carbonate of potash and a fresh distillation. It is not easy however to obtain

a concentrated ether by this mode of purification; and accordingly the London and Dublin Colleges have been led to fix upon the density 750 or even 765 as that of officinal ether.

Sulphuric ether when in a state of purity is a colourless transparent fluid, extremely mobile, of a powerful penetrating peculiar odour, to which the name of ethereal odour is usually given, and of a pungent warm taste followed by a sense of coolness. Its density is variously stated between 700 and 720 at 60°; the most recent results point to 712 as about the correct number; and there is no warrant for the statement of Lowitz, sometimes quoted by chemists, that it may be obtained so low as 632. Ether of higher density than 720 contains alcohol. It boils about the temperature of 96°, and is consequently very volatile and quickly dispersed when exposed at ordinary atmospheric temperatures. In evaporating it gives rise to intense cold. It freezes at —46°. It is very inflammable, and its vapour imparts inflammability to a large volume of air. Owing to this circumstance, together with its volatility, it is necessary not to approach ether with a light in pouring it from one vessel into another. It undergoes decomposition when long kept under access to atmospheric air,—passing gradually into acetic acid and water. It combines in all proportions with alcohol and rectified spirit. It combines also with water in the proportion of one to nine. It dissolves volatile and fixed oils, many resins and balsams, tannin, caoutchouc, some vegetable alkaloids, and a considerable proportion of neutral crystalline principles from the vegetable kingdom. It also dissolves sulphur and phosphorus. Various opinions are entertained of its constitution. Its elementary constituents are four equivalents of carbon, five of hydrogen, and one of oxygen [$C^4 H^5 O$]; and these may be conceived to be variously united so as to form a hydrate of etherine, consisting of one equivalent each of etherine and water [$C^4 H^4 + HO$],—or a hydrate of olefiant gas containing two equivalents of olefiant gas to one of water [$2 C^2 H^2 + HO$],—or a protoxide of an imaginary compound called Ethereum [Kane] or Ethyle [Liebig] [$C^4 H^5 + O$]. Of these views the first seems the simplest and most probable.

Adulterations.—The only prevalent adulteration of ether in this country is with rectified spirit, or with this and water together; but from faulty preparation it may contain ethereal oil or fixed substances. The density is a satisfactory test of the first adulteration; and another convenient method of detecting and measuring any spirit which may be present is by agitating the ether with concentrated solution of muriate of lime as advised by the Edinburgh College. On agitating a given measure in a graduated tube with about twice as much solution of muriate of lime as there is supposed to be alcohol or spirit present, the ether will be freed of the adulteration; and rising to the surface, its proportion may be at once ascertained. The ether of the shops being otherwise usually pure, the Edinburgh College has given no farther test of its free-

dom from foreign admixture. Ethereal oil, which may be present, is discovered, as the London College points out, by water in which the ether is dissolved being rendered turbid. It is better detected perhaps by distilling the ether gently from water; upon which globules of oil will be left floating when the operation is finished.

It is necessary to observe under this head, that the London and Dublin Colleges have recognized as officinal ether an article somewhat adulterated, the density of the London ether being 750, and of that of Dublin only 765. This appears injudicious; since commercial ether is very generally of the density 735, and there is no difficulty in obtaining it of such purity. The Dublin College in admitting also a more diluted ether under the name of *Liquor æthereus sulphuricus* have recognized the *raw* ether of manufacturers obtained in the first distillation,—a very impure article, containing ether, spirit, ethereal oil, and sulphurous acid. If this liquid is admitted for any other reason except to indicate one step in the preparation of sulphuric ether, a more eligible article certainly is the *Spiritus etheris sulphurici* of the Edinburgh and London Colleges, made by diluting ether with twice its volume of rectified spirit. A spirituous ether of this description, united with a little ethereal oil, forms the *Spiritus ætheris sulphurici compositus* of the London College, which is the Sedative liquor of Hoffmann, or a preparation very like that nostrum.

The additional ingredient in this spirit is the *Oleum æthereum* or oil of wine of some chemists, a substance whose nature is not very well ascertained. The preparation of it is somewhat precarious. By the London formula, thirty-three pounds avoirdupois of rectified spirit yield seventeen ounces of ethereal oil (Hennell in Pereira). It is an oily-like fluid of a peculiar odour and bitterish aromatic taste, soluble in rectified spirit and ether, but not in water. It has a density of 1130 (Serullas), and therefore sinks in water. It consists, according to Liebig, of two equivalents of sulphuric acid, eight of carbon, eight of hydrogen, and one of water.

Actions and Uses.—Sulphuric ether is a narcotic, stimulant, antispasmodic, refrigerant, and carminative. It is a narcotic poison when administered in large doses in the liquid state, or freely inhaled in the form of vapour,—producing suspension of sensation and voluntary motion, and many variable affections of the mental faculties. It is one of the most powerful and diffusible stimulants in the materia medica; and by virtue of this property it is also one of the most certain and rapid antispasmodics yet known. This action is strengthened by combining it with opium. Like all powerful stimulant antispasmodics, its purely stimulant action is transient. It acts as a carminative, because, when it enters the stomach, it passes to the state of vapour, and in doing so collects the gases diffused through the contents of that organ. It is a refrigerant only in one circumstance, namely, when dropped on an exposed surface of the skin; and the effect is owing to its prompt

evaporation. It is inconvenient however as such where a continuous refrigerant action is desired, since it must be constantly renewed; but where a transient action only is necessary, its effect is most powerful. When swallowed or inhaled it is absorbed into the system, and afterwards slowly discharged through the lungs; for the breath smells of it for twelve, eighteen, or even twenty-four hours. Habit lessens its influence; so that I have known two ounces taken daily without apparent injury. It has been used as a powerful stimulant in fainting, asphyxia, and the typhoid stages of febrile diseases; but the transient nature of its action renders it inferior in general to alcoholic fluids. It is used externally to remove headache by its evaporation from the forehead or scalp, and sometimes in the same manner as a remedy for external inflammations. But its principal employment inwardly is as an antispasmodic in all forms of spasmodic affections, where it is not contraindicated by its stimulant action. In hysteria, asthma, dyspnœa accompanying diseased heart or emphysema, palpitation, gastrodynia, nervous colic, and the like, it is an invaluable remedy, especially when united with opium or its alkaloidal salts. It is now universally used in the way of inhalation for producing insensibility to pain during surgical operations, as lately proposed by Dr Morton of the United States; and its safety and efficacy in such circumstances have led to its employment in the same way for other purposes. It has been strongly recommended for preventing the sufferings of women in labour [Simpson]. I have used it with marked advantage in tic douloureux and in obstinate hiccup; and its applications of this kind are probably numerous.

It is given inwardly in doses between a fluidscruple and a fluiddrachm, with water alone, or with the addition of syrup, or with an ounce of some aromatic infusion or distilled water. The menstruum ought not to be warm, for an obvious reason. Half a drachm, with as much tincture of opium or solution of muriate of morphia given in a fluidounce of any simple menstruum, and repeated if necessary in fifteen or twenty minutes, constitutes for general purposes the most powerful antispasmodic compound now in use. Occasionally it is administered in the way of injection, and it is said to answer well in that form. The simplest and most effectual way to use it in the way of inhalation is to pour it on the inside of a hollow sponge, and to apply this first near, and then over, the mouth and nostrils. Two ounces are commonly required to cause complete insensibility to pain; but less will arrest spasmodic affections.—— The Oil of wine is not given alone, but the compound spirit of ether, or Hoffmann's anodyne solution, of which it forms a part, is not a bad anodyne for hysteric females, given in the dose of a drachm or upwards.

The preparations and doses of ether internally are:—*Æther sulphuricus*, fl. scr. i. ad fl. dr. i.—*Spiritus ætheris sulphurici*, E.

L. fl. dr. i. ad fl. drs. ii.—*Spiritus ætheris sulphurici compositus*, fl. dr. i. ad fl. dr. ii.

ALCOHOL. *Absolute Alcohol of the density* 794–6 (*Edin.*); 810 (*Dub.*); 815, *Lond.*

TESTS, *Edin.* Density 794–6: when mixed with a little solution of nitrate of silver and exposed to bright light, it remains unchanged, or only a very scanty dark precipitate forms.

TESTS, *Lond.* Density 815; colourless; entirely vaporizable; unites with water or ether; smells and tastes vinous.

PROCESS, *Edin.* Take of
Rectified spirit, a pint;
Lime, eighteen ounces;
Break down the lime into small fragments; expose the spirit and lime together to a gentle heat in a glass mattrass till the lime begins to slake; withdraw the heat till the slaking be finished, preserving the upper part of the mattrass cool with damp cloths. Then attach a proper refrigeratory, and with a gradually increasing heat distil off seventeen fluidounces. The density of this alcohol should not exceed 796; if higher, the distillation must have been begun before the slaking of the lime was altogether finished.

PROCESS, *Lond.* Take of
Rectified spirit, a gallon;
Chloride of calcium, a pound;
Add the chloride to the spirit; and when it is dissolved, distil off seven pints and five fluidounces.

PROCESS, *Dub.* Add to a gallon of rectified spirit three pounds and a half of pearl-ash dried, still warm, and reduced to powder. Digest in a close vessel for seven days, frequently agitating it; pour off the spirit, add a pound of chloride of calcium, and distil with a moderate heat till the residuum grows thick. Density 810.

SPIRITUS RECTIFICATUS, *E. L. D.* *Rectified spirit of commerce.*

TESTS, *Edin.* Density 838 (56 over-proof). Four fluidounces treated with 25 minims of Solution of nitrate of silver (see Tests,) exposed to bright light for twenty-four hours, and then passed through a filter purified by weak nitric acid, so as to separate the black powder which forms, undergo no farther change when again exposed to light with more of the test.

TESTS, *Lond.* Density 838 at 62°: colourless: not rendered turbid by water: tastes and smells vinous. This may be reduced to the state of weak spirit by diluting five gallons of it with three gallons of distilled water.

SPIRITUS TENUIOR, *E. L.* SPIRITUS VINOSUS TENUIOR, *D.* *Proof-spirit.*

TESTS, *Edin.* Density 912 (7 over-proof). Tests otherwise as for rectified spirit.

TESTS, *Lond.* Density 920, as defined by the excise laws. Tests otherwise as for rectified spirit.

PROCESS, *E. L. D.* Mix together three pints of distilled water with six pints (five pints, L., five pints and a quarter, D.) of rectified spirit.

FOR. NAMES.—*Alcohol*,—adopted in most European languages.
Spiritus rectificatus.—*Fren.* Esprit de vin.—*Ital.* Spirito di vino.—*Ger.* Rectificirter weingeist.—*Russ.* Vinnoe spirt.

DISTILLED SPIRIT was known to the Arabians in the twelfth century, probably even earlier; and a century later, Reymund Lully knew how to concentrate it by the affinity of carbonate of potash for its water.

The term Alcohol has been applied in this country in a variety of senses,—an incorrect practice, which has been kept up in some

measure by the authority of the Colleges. The Edinburgh College once used the name to designate a spirit of density 840; and the present Pharmacopœias of London and Dublin apply it to one somewhat stronger, possessing the density of 815 and 810 respectively. In the excise system of this country alcohol is held to have a density of 825. But the term ought to be restricted to the pure or absolute alcohol of chemists, as is now done by the Edinburgh College. To spirit of the density 840 or thereabouts all the Colleges now agree in assigning the ordinary commercial name of Rectified Spirit. The term weak or Diluted spirit is variously applied in the Pharmacopœias. The London and Dublin Colleges agree in applying it to Excise proof-spirit, which has a density of 919 or 920. The Edinburgh College adopted the same standard in the first English edition of its Pharmacopœia in 1839; but has since been led to alter the density to 912, because a spirit of this strength is produced by the simple proportions of one measure of water and two of commercial rectified spirit, and has consequently been long adopted in practice for preparing tinctures by druggists in Edinburgh.

Chemical History.—All spirituous fluids used in the art of pharmacy or in medicine are obtained primarily in this country from the products of fermented grain or sugar, and on the continent from wines. But they may also be prepared from a great variety of farinaceous and saccharine substances, and spirit for common purposes is made in large quantity in Germany from the potato. The spirit obtained from wines is the purest of all. That from barley, which forms almost the whole spirit employed in Britain, is with difficulty freed of impurities which render it less fit for pharmaceutic use. In the first distillation of malt for obtaining spirit a fluid passes over considerably impregnated with water, and highly loaded with a disagreeable essential oil, termed grain oil, the Fusel-oil of continentalists. But by a second distillation a great proportion of this oil is removed, and a spirit easily obtained of the density 896 or 900. By various contrivances the strength and purity of the spirit in the first distillations may be much increased; and by performing the distillation repeatedly the density may be reduced to 825. As it cannot easily be made lower than this without additional means being used, the density of 825 was fixed upon in the British system of excise for pure spirit or alcohol.

For obtaining a spirit of still greater strength and purity various processes have been proposed. These chiefly consist in taking advantage of the superior avidity which certain substances have for water. Some remove the water from the spirit by immediate contact with it, and directly detach the water because they are themselves insoluble in strong spirit. Such a substance is dry carbonate of potass, as employed in the first step of the Dublin process for making alcohol. The carbonate attracts the water from

the rectified spirit, and forms a pulpy semifluid mass at the bottom, leaving a superstratum of strengthened spirit scarcely impregnated with the salt. Other substances, because they are soluble in alcohol, cannot be employed for the purpose of obtaining it pure except along with the process of distillation; of which a good instance is furnished by chloride of calcium in the processes of the Dublin and London Pharmacopœias. It is impossible to obtain completely anhydrous spirit by the method with carbonate of potash; but chloride of calcium and distillation will answer, if the process be repeated, and only one-half of the spirit drawn off each time. Perfectly dry sulphate of copper likewise renders alcohol absolute [Casoria.] The cheapest, readiest, and most complete process, however, for obtaining absolute alcohol is by distilling it from quicklime, as recommended by the Edinburgh College. On using pure quicklime, with the precautions mentioned in the formula, I have always obtained from rectified spirit of the density 838 seventeen-twentieths of its volume of alcohol of density 796; and if the first tenth be kept apart, the rest may be obtained so low as 794.2, but none of it lower according to my observation. A little alcohol still remains with the lime; but if an attempt be made to detach it by raising the heat, decomposition takes place, the lime becomes black, and a naphthous fluid of much higher density passes over. It is commonly said that alcohol made in this way contains a trace of lime; but I have not found it so where a mattrass with a moderately long neck was used.

Other ingenious methods have been proposed for obtaining alcohol without direct contact of the substance which appropriates the water. If a hydrated alcohol of considerable strength be placed along with quicklime in vacuo, the whole of the water is gradually absorbed by the lime, with but little loss from absorption of alcoholic vapour (Graham.) A vacuum is not here necessary, although it accelerates the process, for I have found that, if rectified spirit be simply confined under a glass jar with quicklime, it will attain in two months and a half the density of 796.3; and the loss sustained through absorption by the lime was only eight per cent of the alcohol contained in the spirit. Another singular process, first mentioned by Sömmering the anatomist, is by covering the spirit in a glass jar with bladder, and exposing the vessel to dry air. It is stated that in this way nearly the whole water will by degrees escape, with very little loss of alcohol. Some have failed to obtain Sömmering's results; but spirit is certainly strengthened, as I have found, if the air over the bladder be kept dry as the watery vapour escapes.

It is by no means so easy to free spirit of the essential oil with which it is always impregnated, as to deprive it of water. A considerable part may be removed by adding water previous to each distillation. An effectual method is by distillation from chloride of lime, which converts the oil into a resin; but unfortunately the

chloride reacts also on the alcohol, and gives rise to new impurities. The plan generally preferred is the less perfect one by digestion with charcoal, especially with animal charcoal. Others have recommended to distil the spirit from almond oil, which is said to retain the volatile oil. According to Liebig the purest of all spirit is obtained by distilling that which has been used for obtaining pure caustic potash. An effectual way of removing the oil on the small scale, but one scarcely applicable in large processes, is to add a little of the solution of nitrate of silver and expose the spirit to bright light. A black powder soon forms, which is occasioned by decomposition of the oil through means of the oxide of silver; and a fresh distillation then yields a spirit free of all oleaginous impurity.

Alcohol is a colourless, transparent, very mobile fluid, possessing a peculiar, pleasant odour, and a strong burning taste, which is greatly diminished by slight dilution. It has not yet been congealed. Its boiling point is between 172° and 176°. It quickly evaporates when exposed to the air. Its density is variously stated between 794 and 796: according to Richter it is 793.9 at 60° F. It kindles with facility, burning with a clear blue flame and emitting no smoke; but when burnt slowly, as by red-hot platinum wire, it is consumed without flame, and modified acetic acid is produced. It combines with water in every proportion; and their union is attended with the disengagement of heat and some condensation of volume. Its avidity for water is such as to remove that fluid quickly from the atmosphere. It is decomposed by most acids, forming ethers. It simply dissolves the caustic alkalis, and has no effect on their carbonates, at least those of the fixed alkalis. It dissolves most of the muriates that are easily soluble in water, some of the nitrates, but none of the metallic sulphates. It also dissolves iodine, phosphorus and sulphur, the last two in small proportion. It is a powerful solvent of many vegetable principles, especially those that exert an action on the animal system, such as the vegetable alkaloids, most neutral crystalline principles, extractive matters, sugar, tannin, very many resins, all essential oils, and most fixed oils, fluid as well as concrete. Alcohol is therefore a most important vehicle in pharmacy, as well as a very useful agent in pharmaceutic chemistry generally. Under the conjunct influence of certain vegeto-animal matters, or of spongy platinum, and of atmospheric air, it passes into acetic acid at a moderate elevation of temperature. It is composed of two equivalents of carbon, three of hydrogen, and one of oxygen, that is 12.24 parts of carbon, 3 hydrogen, and 8 oxygen; but there are strong reasons for viewing it rather as a compound of twice that number of equivalents of each element. It has been considered, and may be viewed, as a compound, either of ether and water in the proportion of one equivalent of each ($C^4 H^5O + HO$), or of one equivalent of olefiant

gas and one of water ($H^2 C^2 + HO$), or of etherine, the radical of ether, and two equivalents of water, $H^4 C^4 + 2 HO$.

Rectified spirit is not essentially different from alcohol in its properties. It has a less acrid taste, boils at a higher temperature, feebly dissolves some substances which alcohol does not act upon, and on the contrary is a less powerful solvent of other substances, for example of some fixed oils and resins. But in other respects its properties are essentially the same.

Diluted spirit has likewise similar properties. It is however feebly inflammable, and its properties as a solvent are different. In an impure state it constitutes the several kinds of ardent spirit used in various quarters of the globe. These are sometimes substituted for pure diluted spirit as a pharmaceutic solvent. But they ought not to be applied to that purpose,—even the whisky of Scotland and of Ireland being not pure enough.

It is of great practical consequence in Pharmacy to be able to determine accurately and easily the strength of spirit. For this purpose many contrivances have been proposed, all of which are based fundamentally on its variations in density. Some of these indicate by their scales the actual densities, others indicate expressly the percentage of absolute alcohol, others present arbitrary numbers which have a relation to certain special objects held in view by the Excise laws. The most philosophical instrument is the Alcohometer of Gay-Lussac, which is a hydrometer whose scale indicates at a fixed temperature the percentage of pure alcohol. But it has not yet come into use in this country. For chemical purposes in Britain hydrometers are commonly preferred which indicate expressly the density. In France and several other continental countries an arbitrary scale has long been in general use, that of Baumé, in which zero indicates the density of a solution of one part of common salt and nine of water, and 10° the density of water itself; in consequence of which it is found that absolute alcohol marks 46° with this instrument, or 47° according to some experimentalists. The British excise system has introduced into common use in this country a scale equally artificial, which, setting out with proof-spirit of density 920 as the standard for its zero, indicates the percentage of water on the one hand, or of spirit of 825 on the other hand, that must be added to any given spirit to bring it to the density of proof-spirit. Thus by spirit "ten over proof," which is the strength of fine brandy and whisky, is understood a spirit which requires for every hundred volumes the addition of ten volumes of water to reduce it to proof of 920. By spirit "ten under proof" is understood one which requires ten volumes of spirit of 825 for every hundred volumes to raise it to the strength of proof. This is the scale by which spirits are purchased by the druggist from the rectifier. It is desirable that the student be acquainted with the relation of these several scales to one another, otherwise it will be impossible for him to comprehend the treatises

on practical pharmacy of this and other countries. I have therefore appended the following table, which contains in the first column the densities at 60° F.; in the second column the proportion by weight of spirit of 825 in 1000 parts of each density, as determined by the elaborate researches of Gilpin; in the third the indications according to Baumé's areometer, as ascertained by Francœur at the temperature of 54.5 F.; in the fourth the indications of the hydrometer used by the British excise, that of Dicas and Sykes; in the last the percentage of absolute alcohol by volume according to the late inquiries of Gay-Lussac, and as indicated by his alcohometer. Other authorities have stated the relationships of these several scales differently; but the data in the table are probably the most trustworthy.

Density.	Spir. 825 by wt.	Baume.	Dicas & Sykes.	G. Luss. by vol.	Density.	Spir. 825 by wt	Baumé.	Dicas & Sykes.	G. Luss. by vol.
795	...	47.7	...	100	876	768	...	34	76
796	...	...	...	...	878	757	..	32	75.3
798	...	47.0	...	...	880	746	30.1	30	74.3
800	...	...	...	99	882	738	...	29	73.7
802	...	46.0	...	...	884	729	29.1	28	73
805	...	...	...	98	886	719	...	27	72
806	...	45.2	.	...	888	709	...	25	71
808	..	...	..	...	890	699	28.0	24	70.3
810	...	44.2	...	97	892	689	...	22	69.3
812	...	..	..	...	894	680	...	20	68.7
814	..	...	...	96	896	671	27.0	19	68
816	...	42.9	...	..	898	662	..	17	67.3
818	..	...	...	95	900	649	26.2	15	66.7
820	...	42.0	...	...	902	641	...	14	66
822	...	...	.	94	904	631	...	12	65
824	..	41.2	...	...	906	621	25.1	11	64
825	1000	41.0	63	...	908	612	...	10	63.3
826	993	...	62	93	910	602	...	8	62.3
828	984	..	61	92.3	912	591	24.1	7	61.5
830	975	39.9	60	91.7	914	581	...	5	60.5
832	966	..	59	91	916	571	23.0	3	59.6
834	957	39.0	58	90.3	918	562	...	1	59
836	949	...	57	89.7	920	550	...	0	58
838	940	...	56	89	922	540	...	— 2	57
840	932	37.8	55	88.5	924	531	22.0	— 4	56
842	924	...	54	88	926	521	..	— 6	55
844	916	37.0	53	87.3	928	510	...	— 7	54
846	908	...	52	86.7	930	500	21.0	— 9	53
848	898	36.2	50	86	932	489	...	—11	52
850	888	...	49	85.3	934	479	...	—13	51
852	878	..	48	84.7	936	468	20.0	—15	50
854	868	35.0	47	84	938	456	...	—17	49
856	857	...	46	83.3	940	444	...	—19	48
858	849	34.2	45	82.7	942	432	19.0	—21	46.5
860	840	..	45	82	944	421	...	—23	45.5
862	833	...	44	81.3	946	411	...	—24	44
864	823	33.0	43	80.3	948	397	18.0	—26	43
866	813	...	42	79.6	950	382	...	—28	41.5
868	807	31.2	40	79	952	370	...	—31	40.5
870	798	...	39	78.3	954	358	17.0	—34	39
872	787	...	38	77.7	956	346	...	—36	38
874	776	31.0	36	77	958	333	...	—39	36.5

Density.	Spir. 825 by wt.	Baumé.	Dicas & Sykes.	G. Luss. by vol.	Densit		é	Dicas & Sykes.	G. Luss by vol.
960	315	16.1	—42	35	980	150	13.0	—75	16
962	300	...	—45	34	982	135	...	—77	14
964	285	...	—48	32	984	120	...	—80	12
966	270	15.1	—51	30	986	105	12.1	—82	10.5
968	253	...	—54	28	988	90	...	—85	9
970	236	...	—57	26	990	75	...	—89	7
972	218	...	—60	24	992	60	11.2	—92	6
974	200	13.9	—64	22	994	45	...	—95	4
976	...	...	...	20	996	30	...	—96	3
978	175	...	—72	18	998	15	...	—98	1

Adulterations.—The adulterations of alcohol and the weaker spirits are not numerous. What is sold as alcohol or rectified spirit may be adulterated with water; which is at once discovered by the density. In applying this criterion uniformity of temperature is an essential condition: The thermometer must mark 60° according to the Edinburgh and Dublin Pharmacopœias, 62° according to that of London. For example genuine rectified spirit of the standard density 840, if examined at the temperature of 40° would appear to be only 849; and at the temperature of 72° would mark 834. Another adulteration and the only one else of much consequence, is grain-oil. The presence of a considerable proportion of this substance, by reason of its unpleasant aroma, renders spirit comparatively unfit for some pharmaceutic purposes, such as making the finer tinctures, and greatly inferior to the spirit from wines for making all sorts of liqueurs and perfumes. The superiority of the continental liqueurs in particular over those made in Britain is commonly and justly ascribed to the difficulty experienced in this country in obtaining a spirit sufficiently free from the oil of grain. In consequence of the abundance of this and other matters of an empyreumatic nature in the common proof spirit of British commerce, that fluid ought not to be used for preparing officinal tinctures; and the Pharmacopœias properly direct that the menstruum for all tinctures shall be made by diluting rectified spirit with distilled water. Rectified spirit is much more free of grain-oil than common spirits. That which is obtained from wine is of great purity. But that produced from grain, which is the only kind to be had in Britain, is always more or less impregnated with grain-oil. It may be purified by one or other of the methods mentioned above. The adulteration may be detected by the action of an equal volume of pure concentrated sulphuric acid, which when mixed with pure rectified spirit occasions no change of colour, but produces redness or brownness if grain-oil be present. For this purpose it is advisable to use pure sulphuric acid, otherwise the disengagement of sulphate of lead obscures the result by imparting milkiness to the mixture. Another method which answers still better is to add solution of nitrate of silver, and expose the spirit to the sun's rays or diffuse light, which will not affect a pure spirit, but will gradually occasion a

black precipitate with any grain-oil that may exist in it. The presence of fixed substances in solution, which is provided against by the formula of the London College, is not likely to occur, because the effect is to raise the density and lower the apparent quality of the spirit.—Pure alcohol, which however is not at present to be met with in the shops, is much more free of oil than rectified spirit: but still, as prepared by the Edinburgh process, it is discoloured somewhat by sulphuric acid, or nitrate of silver and light. The presence of even a small quantity of water is shewn by the grey anhydrous sulphate of copper becoming blue.

Actions and Uses.—Alcohol is in its action a local irritant and astringent, and secondarily a sedative; and remotely or generally it is, according to circumstances, stimulant or sedative, and also diuretic. Its local irritant action is seldom well marked, but is exemplified by the redness it produces when freely applied to the tender skin, or when administered in a large dose to an animal so as to act powerfully on the mucous membrane of the stomach. Its local irritant action is marked by pain; but the speedy departure of this symptom, and the substitution of numbness and insensibility of the part, prove that a sedative effect is soon developed as a secondary phenomenon. Its astringent action is illustrated by the corrugation of the skin where it has been long applied, and by its property of arresting hemorrhage; and is probably owing in part to its avidity for water, though chiefly to its chemical property of coagulating albumen. Much difference of opinion has prevailed as to the nature of its general or remote actions; but they are rendered intelligible enough if attention be paid, on the one hand to the modifying influence of dose, and on the other to its twofold action, on the nervous system and on the circulation. A small dose excites both the circulation and the brain, without any sensible consecutive depression below the healthy standard. A larger dose causes at first greater excitement of both systems, and secondarily depression of the functions of the brain, especially those of external relation; but the excitement of the circulation may in this case go on, and ultimately cease without consecutive depression. When the dose is still larger, the secondary depression of the nervous system supervenes swiftly; and in that case, probably from the nervous depression reacting on the heart, the excitement of the circulation speedily gives place to a corresponding depressed state. When the dose is very large, as where a great quantity of spirit is swallowed at once for a wager, there is scarcely any appreciable excitement of the brain, it is so speedily overwhelmed by the consecutive depression; and this state of the brain seems to react with such force upon the heart, that the circulating system too presents but imperfect and transient traces of stimulation. The sedative action of alcohol on the brain constitutes it a powerful narcotic poison. For its effects as such, if rapidly brought on by a large dose, there is no antidote known,—the only efficacious treatment consisting of speedy

evacuation of the stomach and the employment of brisk external stimuli. The best and safest stimuli of this kind are loud talking, agitation of the body, the injection of water into the ears, tickling of the nostrils, and the cold affusion of the head and shoulders. In cases of narcotism brought on more slowly, as in ordinary intoxication, internal stimulants are also useful, such as ammonia. The acetate of ammonia, alleged to be a specific in the like circumstances, is a dubious remedy. The cumulative effects of alcohol as a poison cannot be properly considered in this place. Its frequent abuse acts injuriously by developing certain diseases, by bringing to a head certain dispositions to disease, by rendering diseases at large comparatively intractable, and by rendering the constitution unable to withstand the active treatment required for many acute diseases. It is chiefly in the last two modes that this habit influences the general mortality.—Alcohol is absorbed when spirituous fluids are taken internally; for the breath smells of it long afterwards, and it may be discovered by chemical analysis in the brain (Percy).

The stimulant and secondary sedative action of alcohol is turned to account in various local disorders. It forms a principal ingredient in most evaporating lotions used in surgery. It is a good application in all external inflammations connected with an enfeebled state of the body, as in erythema during fever and other exhausting diseases. By some it has been applied more generally in external inflammations, in the treatment of erysipelas, and in gangrene. In hydrocele it is employed, after the removal of the fluid, for exciting adhesive inflammation of the tunica vaginalis, for which end it is injected into the cavity in a state of considerable dilution. The sedative and narcotic action of alcohol as an internal agent is not turned to use in the practice of medicine, although proposals to this effect have been sometimes made. It is freely used however in small doses as a stimulant. Wine is indeed the form in which it is most generally used in regular practice; but in the shape of ardent spirits it is employed empirically to a great extent in domestic medicine, as for the removal of nervous colic, for rousing from a state of syncope, and for the treatment of gastrodynia and other symptoms of indigestion. For these purposes it is a perilous remedy when resorted to frequently, because apt to lead to the vice of habitual over-indulgence. Yet it is undoubtedly an excellent and often indispensable remedy in prolonged fainting; and in typhoid fever, as well as the typhoid forms or stages of other febrile diseases, it must often be given instead of wine, because the latter is not stimulant enough. It may be particularly called for in typhus occurring in persons addicted to intemperance; for in them wine sometimes exerts no influence at all as a stimulant. Some employ it in eruptive diseases when the constitution appears oppressed by the eruption being imperfectly developed; and it is of service where a state of debility of the circulation prevails. Alcoholic liquids are all more or less diuretic; and this action is most

easily excited when they are given considerably diluted. Mere alcohol however is seldom used as a diuretic in regular practice; but it is a powerful and familiar remedy of the kind when united with certain diuretic essential oils, of which combinations the most esteemed is hollands.

It is used externally in a great variety of shapes. As a stimulant lotion it may be usefully united with distilled vinegar and various salts, such as muriate of ammonia. A common discutient lotion consists of equal parts of distilled vinegar and rectified spirit holding half an ounce of muriate of ammonia dissolved in every pint of the mixture. An excellent application in the early stage of excoriation from pressure in fever and other exhausting diseases, is a mixture of equal parts of rectified spirit and white of egg, which is to be applied frequently with a fine brush or feather, and renewed as it dries till an albuminous coating is formed over the part. The doses for internal use are so various that it is impossible to specify them. In fever, fainting, and other states of nervous exhaustion, there is commonly a remarkable power in the constitution of resisting the intoxicating tendency of alcoholic liquids; so that very large quantities may be taken continuously without affecting the brain, and indeed must be given to attain the desired stimulant operation on the circulating system.

It has been already observed that alcohol in all its forms is a highly valuable pharmaceutic agent.

ALLIUM, *E. L. D. Bulb of Allium sativum (L. W. Spr.) Garlic.*

FOR. NAMES.—*Fren.* Ail.—*Ital.* Ag io.—*Span.* Ajo.—*Port.* Alho.—*Ger.* Knoblauch.—*Dut.* Knoflook.—*Swed.* Hwitlök.—*Dan.* Hvidlog.—*Russ.* Tschesnok.—*Arab.* Soom.—*Pers.* Seer.—*Tam.* Vullay poondoo.

FIGURES of Allium sativum in Hayne, vi. 6.—Roque, 30.—St. and Ch. iii. 111.

GARLIC has been used in medicine from a very remote date. It was the Σκοροδον of the ancient Greek physicians.

Natural and Chemical History.—It is the bulb of a familiar liliaceous plant, a native of Sicily, Spain, and Egypt, and often cultivated in the gardens of this country. It belongs to the Linnæan class and order *Hexandria monogynia*, and to the natural family *Liliaceæ* of most natural arrangements. The root proper is surmounted by several small bulbs grouped together within a common membranous covering. The stem is two or three feet high and bears a head of many whitish flowers emerging from a common sheath or spatha, and expanding in July. The bulb, the officinal part of the plant, has a strong odour like that of assafœtida, and an acrid, sweetish, peculiar taste. These properties are imparted to water, vinegar, and syrup. The bulb consists of gum, sugar, albumen, inert extract, ligneous fibre, and a minute quantity of a citrine volatile oil, heavier than water, intensely penetrating in its odour, and of a strong acrid garlicky taste. This oil is the active princi-

ple of the bulb. It contains, like certain other heavy acrid essential oils, a small proportion of sulphur.

Actions and Uses.—Garlic was highly esteemed by the ancient physicians and earlier moderns; and though it has fallen into disuse in regular practice in this country, it is still a favourite domestic remedy. It is an irritant and stimulant, a diuretic, diaphoretic, anthelmintic, and emmenagogue. When applied to the skin in the fresh state, or cut and beat into a pulp with water, it causes redness, burning pain, and subsequently desquamation of the cuticle. A liniment prepared by beating two cloves of garlic with an ounce of olive oil is a useful external stimulant. Garlic taken internally stimulates the stomach and likewise the general circulation. On account of the former property it is used to an enormous extent as a condiment in some countries, especially in Spain, and is thought necessary there for those who use a viscous, indigestible kind of food composed largely of vegetables. It communicates a strong, disagreeable, persistent odour to the breath. It disorders the stomach of those unaccustomed to it, and when used in excess produces headache, garlicky eructations and febrile restlessness. A few drops of its juice will sometimes arrest nervous vomiting. Some hold it to be so good a diuretic as even to use it familiarly in dropsy. Its diaphoretic virtues are more doubtful. Neither can much reliance be placed in it as an emmenagogue. But it is undoubtedly often an excellent remedy in ascarides. It has been long celebrated for its anthelmintic properties in that variety of intestinal worm; and Roque says he has often experienced the greatest success from employing at the same time infusions by the mouth, clysters of its infusion, and friction with a liniment over the abdomen. Garlic is far from being inert as some suppose; and it would probably be more in use, but for the repugnance entertained towards it by patients in this country on account of its powerful unpleasant odour.

ALOE, *L.* ALOE SOCOTORINA, *E. D.* *Inspissated juice of the leaves of Aloe spicata, DC. (Lon.); of Aloe spicata, Persoon (Dub.); of an undetermined species of Aloe, L. W. Spr. (Edin.) Socotorine aloes.*

TESTS, *Edin.* In thin pieces translucent and garnet-red: almost entirely soluble in spirit of the strength of sherry. Very rare.

ALOE BARBADENSIS, *E.* ALOE HEPATICA, *D.* *Inspissated juice of Aloë vulgaris, DC. (Dub.) Extract or inspissated juice of one or more undetermined species of Aloe, L. W. Spr. (Edin.) Barbados aloes.*

ALOE INDICA, *E.* ALOE HEPATICA, *D.* *From Aloë vulgaris, DC. (Dub.) From one or more undetermined species of Aloë, L. W. Spr. (Edin.) East-Indian Aloes.*

DECOCTUM ALOES, E. DECOCTUM ALOES COMPOSITUM, L. D.

PROCESS, *Ed. Lond. Dub.* Take of
Socotorine (or Hepatic, *E. D.*) aloes;
Saffron; and
Myrrh, bruised, of each one drachm (and a-half, *L.*)
Extract of liquorice, half an ounce, (seven drachms, *L.*)
Carbonate of potass, two scruples (3, *L.*)
Compound cinnamon tincture, four (seven, *L.*) fluidounces.
Water, sixteen (thirty, *L.*) fluidounces.
Mix the aloes, myrrh, saffron, liquorice and carbonate of potash with the water; boil down to twelve (twenty, *L.*) fluidounces; filter and add the compound cinnamon tincture.

EXTRACTUM ALOES HEPATICAE, D.

PROCESS, *Dub.* Take of
Hepatic aloes, one part;
Boiling water, eight parts.
Boil down to one-half; express; let the impurities subside; filter; concentrate at 200° or 212° till the liquid is thickish, and then over the vapour-bath, with frequent stirring, to the consistence for pills.

EXTRACTUM ALOES PURIFICATUM, L.

PROCESS, *Lond.* Take of
Aloes bruised, fifteen ounces;
Boiling water, a gallon.
Macerate with a gentle heat for three days; let the impurities subside; evaporate the purified liquor over the vapour-bath, stirring near the close, till it attain the consistence of pills.

PILULAE ALOES, E.

PROCESS, *Edin.* Take of
Socotorine-aloes, and
Castile-soap, equal parts;
Conserve of red-roses, a sufficiency.
Beat them into a proper pill mass.
This pill may also be correctly made with the finer qualities of East-Indian aloes, as the Socotorine variety is very scarce; and many prefer, not without reason, the stronger Barbados aloes.

PILULAE ALOES COMPOSITAE, L. D.

PROCESS, *Lond. Dub.* Take of
Socotorine (Hepatic, *D.*) aloes in powder, one ounce;
Extract of Gentian, half an ounce;
Caraway-oil, forty minims;
Simple syrup, a sufficiency.
Beat them together into a uniform mass for pills.

PILULAE ALOES ET ASSAFOETIDAE, E.

PROCESS, *Edin.* Take of
Socotorine or East-Indian aloes,
Assafoetida, and
Castile-soap, equal parts.
Beat them with conserve of red roses into a proper pill mass.

PILULAE ALOES ET FERRI, E.

PROCESS, *Edin.* Take of
Sulphate of iron, three parts;
Barbados aloes, two parts;
Aromatic powder, six parts;
Conserve of red roses, eight parts.
Pulverise the aloes and sulphate of iron separately; mix the whole ingredients; and beat them into a proper mass, which is to be divided into five-grain pills.

PILULAE ALOES ET MYRRHAE, E. L. D.

PROCESS, *Edin.* Take of
Socotorine or East-Indian Aloes, 4 parts;
Myrrh, two parts;
Saffron, one part.
Beat them into a proper pill mass with a sufficiency of Conserve of red roses.

PROCESS, *Lond. Dub.* Take of
Aloes (Hepatic, *D.*) two ounces;
Myrrh, and
Saffron, of each an ounce;
Syrup, a sufficiency.
Pulverise the aloes and myrrh separately; and then beat the whole into a uniform mass.

PULVIS ALOES COMPOSITUS, L.

PROCESS, *Lond.* Take of
Aloes, an ounce and a-half;
Guaiac-resin, one ounce;
Comp. cinnamon powder, half an ounce.
Pulverise the aloes and guaiac apart; then mix the whole together.

PULVIS ALOES CUM CANELLA, D.

PROCESS, *Dub.* Take of
Hepatic-aloes, one pound;
Canella, three ounces.
Pulverise them separately and mix them.

TINCTURA ALOES, E. L. D.

PROCESS, *Edin.* Take of
Socotorine or East-Indian aloes coarsely powdered, one ounce;
Extract of liquorice, three ounces;
Rectified spirit, twelve fluidounces;
Water, one pint and eight fluidounces.
Mix and digest them for seven days, with occasional agitation; filter the clear liquor separated from the sediment.
This tincture cannot, without difficulty and delay, be prepared by percolation.

PROCESS, *Lond.* Take of
Aloes bruised, one ounce;
Extract of liquorice, three ounces;
Distilled water, a pint and a half;
Rectified spirit, half a pint.
Macerate for fourteen days and filter.

PROCESS, *Dub.* Take of
Socotorine aloes powdered, half an ounce;
Extract of liquorice, an ounce and a half;
Boiling water, eight ounces;
Proof-spirit, eight fluidounces.
Dissolve the liquorice in the water, add the aloes and spirit, digest for seven days and then filter.

TINCTURA ALOES ET MYRRHAE, E. TINCTURA ALOES COMPOSITA, L. D.

PROCESS, *Edin. Lond.* Take of
Aloes, in coarse powder (Socotorine or East-Indian, *E.*) four ounces;
Saffron, two ounces;
Tincture of myrrh, two pints.
Macerate for seven (fourteen, *L.*) days, and filter. This tincture cannot well be prepared by percolation.

PROCESS, *Dub.* Take of
Socotorine aloes, three ounces;
Tincture of myrrh, two (old wine) pints.
Macerate for fourteen days, and filter.

VINUM ALOES, E. L. D.

PROCESS, *Edin.* Take of
Socotorine or East-Indian aloes, an ounce and a half;
Cardamom-seeds, ground, and
Ginger in coarse powder, of each one drachm and a half;
Sherry, two pints.
Digest for seven days, and strain through linen or calico.

PROCESS, *Lond.* Take of
Powdered aloes, two ounces;
Bruised canella, four drachms;
Sherry, two pints.
Macerate for fourteen days, agitating occasionally; and then strain.

PROCESS, *Dub.* Take of
Socotorine aloes, four ounces;
Canella, an ounce;
Sherry, three pints;
Proof-spirit, a pint.
Pulverise the aloes and canella separately; mix them; add the wine and spirit, digest for fourteen days, agitating occasionally; then filter.

FOR. NAMES.—*Fren.* Aloës; Suc d'Aloës.—*Ital.* Aloë.—*Span.* Aloe.—*Port.* Azevre.—*Ger.* Aloe.—*Dut.* Aloe.—*Swed.* Aloe.—*Dan.* Aloe.—*Russ.* Sabur obiknovennoi.—*Pers.* Sibbir.—*Tam.* Carriabolum.—*Hind.* Elwa.

FIGURES of Aloë vulgaris in Nees von E. 50.—Roque, 27.

FIGURES of Aloë Socotorina in Nees von E. 51.—Roque, 26.—Decandolle, Plant. succ. 85.—Steph. and Ch. iii. 110.

ALOES appears to have been known from an early period in the history of medicine; for Dioscorides mentions under the name of Αλοη a cathartic substance obtained from a plant, which was in all probability the *Aloë vulgaris* of modern botanists, one of the species ascertained to furnish the present officinal drug.

Natural and Commercial History.—The whole pharmacology of this substance has been involved for some time in much confusion; which has arisen from the great demand for it having occasioned an unusual multiplication of its commercial sources, and consequently led to the employment of a number of allied species of plants for preparing it. Within a few years past the drug has been imported into Britain from Bombay, Arabia, Socotora, Madagascar, the Cape of Good Hope, the Levant, and the West Indies; and at the present moment the aloes of British commerce is actually derived more or less from most, if not from all of these quarters directly or indirectly. It seems unlikely, that in places so distant from each

other the drug is obtained from only one, two, or even three species of plants, or that it is prepared according to the same process. All the plants however which yield it belong to the genus *Aloë*, which is arranged with the *Liliaceæ* in the natural arrangement, and in Linnæus' class and order *Hexandria Monogynia*. It is generally imagined that at least three species furnish the different kinds of aloes known in the English market, namely *A. vulgaris*, *spicata*, and *Socotorina*; it is probable that at least two other species, the *A. linguæformis* of Thunberg, and the *A. Commelini* of Willdenow are likewise employed; and we can scarcely suppose, that, in a genus so numerous, and composed of species so similar, even these five exhaust the whole catalogue of plants in actual use. It must be farther remarked that the distinctions between the several species supposed to yield the drug have not hitherto been very exactly determined.—The London College has attempted to escape these botanical difficulties by assuming, that only one variety of aloes is fit for medicinal use, namely Socotorine aloes,—and that this sort is obtained only from the *A. spicata*. But the former proposition will be presently seen to be positively false; and the latter is very far from being proved to be true. The fact is, our information as to the botanical sources of aloes still remains extremely vague; and it seems better to avoid the difficulties altogether, as the Edinburgh College has done, by declining to fix upon the positive species, than to commit unequivocal errors by aiming at unattainable precision. The species from which the drug is known to be obtained are characterized by producing large, thick, fleshy leaves, stiff and brittle, pointed and generally terminating in a strong spine, commonly provided with numerous powerful teeth, filled with a mucilaginous pulp internally, and containing in the proper vessels of their exterior portion an intensely bitter juice which yields the medicinal substance aloes. The plant throws out from the middle of the leaves a long flower-stalk crowned by numerous tubulated and often bilabiate flowers, arranged in a spike, and generally of great beauty. Aloes consists of the proper juice of the leaves, sometimes obtained, it is said, in the form of tears by incision, spontaneous exudation and inspissation upon the plant,—sometimes by spontaneous evaporation of the juice which drops or exudes by pressure, from the leaves when cut away near their base,—sometimes by evaporating the same juice with the aid of heat,—and sometimes by evaporating together the juice and a decoction of the leaves.

From the several sources, and in the several ways, now described, are obtained at least six kinds of aloes, which are distinguished from one another in commerce, namely Clear, Socotorine, East-Indian, Barbados, Cape, and Caballine aloes. Of these the London College admits the Socotorine alone; but the two other Colleges acknowledge also the East-Indian and Barbados varieties.

1. The term Clear Aloes (Aloë lucida) is variously under-

stood by pharmacologists. It seems, to have been originally applied to a species now extinct, or nearly so, as an article of trade, consisting of small, roundish, red, translucent, shining masses, either obtained as tears from the leaves after incisions, or prepared by spontaneously evaporating the juice extracted by incisions and exudation. I have never seen an undoubted specimen of this variety. But the name is also applied by some to what appears to be the finest variety of Socotorine aloes,—and perhaps correctly, since all the characters just given apply with precision, except the form and size of the pieces.

2. Socotorine Aloes (Aloë Socotorina, Socotrina, Succotrina), so named from its supposed source, the island of Socotora, near the mouth of the Arabian Gulf, has long been the most esteemed of all varieties in medical practice. Much confusion has arisen in the nomenclature and description of some of the varieties of aloes in consequence of this kind having almost disappeared for several years from the European market. In 1834, every wholesale druggist and drug-broker I met in London agreed, that real Socotorine aloes had been scarcely seen for ten or twenty years in the London market, except incidentally and in small quantity in the form of layers in the East Indian sort. This statement agreed with information communicated to me about the same time by Dr Allan of Forres, who, on visiting the island of Socotora a few years before, found that the natives were not acquainted with aloes as a product of the island,—and likewise with my own observation, that what was to be found in first-rate retail-shops or in private and public collections as the Socotorine kind, was nothing else than fine East-Indian aloes. It has been recently ascertained, however, by Lieutenant Wellsted that aloes is really manufactured at Socotora, though only to the amount of a few tons annually; and there is now occasionally imported into London, though still in small quantity, an article presenting the characters of Socotorine aloes as given by pharmacologists about the beginning of this century,—and professedly derived from the islands of Socotora and Madagascar. In consequence of its rarity some late pharmacologists have withdrawn from their descriptions of the different kinds of the drug that formerly given of true Socotorine aloes. Others, following the prevalent practice of druggists, use this name to denote the good qualities of East Indian aloes. Dr Pereira in particular holds them to be the same in their source and characters, and to differ merely in quality; and since seeing his inquiries into the subject, I was disposed to coincide with him. I find however that good practical judges in London still hold the opinion that a true Socotorine aloes may be distinguished from that which is often called such, and which is the third species I have adopted. It has therefore appeared to me advisable to retain the name in scientific pharmacological language with its restricted meaning, and to

describe what has been brought under my notice as the true Socotorine kind.

The finest variety I have seen, which is in the possession of Dr Douglas Maclagan of this city, cannot be traced to its commercial source. It consists of small angular fragments, possessing a deep garnet-red colour altered somewhat by exposure, a conchoidal fracture, a full resinous lustre, much translucency in thin layers, a beautiful garnet-red hue by transmitted light, and a peculiar fragrant odour. It is brittle, easily pulverisable, and of a fine golden-yellow tint when in powder. It is almost entirely soluble in spirit of the density 950, a very scanty light flocculent matter being left. —The next is a specimen from a considerable consignment purchased by an eminent wholesale druggist in London in 1839, and represented to him to have been imported from Socotora. The pieces are about the size of the fist and obviously fragments of larger masses. They present generically the characters of the last specimen; but the tint is scarcely so fine, the fracture rougher, the lustre not so high, the colour by transmitted light less purely garnet-red and rather inclining to brownish-red, and the fleecy residue of the action of weak spirit not so scanty. These two specimens seem to differ little from the description given of Clear aloes by some pharmacologists except in size and form, and they answer to old descriptions of the true Socotorine. I have seen likewise a specimen like the second, which was said to have been imported from Madagascar.——The third variety was picked by myself in 1834 in a London wholesale warehouse from a layer in a huge mass of East-Indian aloes. The pieces present equal lustre, translucency and brittleness with the last; but they are much paler, their tint by transmitted light is rather yellowish-brown with a slight shade only of red, they have a less agreeable odour, and they leave a larger flocculent residue when acted on by weak spirit. This sort, regarded by the donor as very nearly true Socotorine aloes, can nevertheless be scarcely considered as such. But along with the next, it constitutes as it were the passage from true Socotorine to the usual qualities of commercial East-Indian aloes.—— The fourth and last variety to be mentioned, which has been repeatedly sent to me as the Socotorine kind, presents a dark brownish-red colour, considerable lustre when fresh broken, though little on an old surface, a yellowish-brown translucency on the edges only or in very thin splinters, and a less agreeable odour than any of the preceding specimens; and it leaves a much greater flocculent residue when dissolved in weak spirit. All specimens of this kind seem really nothing but the finer sort of East-Indian aloes.

The subject must be admitted to be involved in difficulties; but I am still inclined to think that the simple characters given in the Edinburgh Pharmacopœia,—a garnet-red translucency in thin pieces, and almost complete solubility in spirit of the strength of sherry,—define accurately a particular species of aloes; which is

the true Socotorine aloes of former pharmacologists. In retaining their name however, it is not intended to be assumed that the actual commercial source of the drug is yet sufficiently ascertained.—— Its botanical source and mode of preparation are quite undetermined. It is commonly stated, but on no good authority, to be produced by the *Aloë Socotorina* of Decandolle; and it is conceived to be obtained by cutting off the leaves, allowing them to drain into vessels, and then evaporating the juice in the sunshine without artificial heat.

3. East-Indian Aloes (Aloë Indica,—Hepatica), so called because imported into Europe from Bombay, and sometimes termed Hepatic aloes from its predominating liver-brown colour, is not the produce of the country whose name it bears. Aloes is manufactured in India; but of various specimens I have received from medical officers in the East-India Company's service, there is none but what is coarse and altogether unlike that imported into Britain under the name of East-Indian aloes. This variety is understood to be obtained primarily from the coasts of the Arabian Gulf and adjoining ocean, Bombay being merely the entrepôt through which it is transmitted to Europe. It is imported in very large masses without any covering between them and the boxes used for containing it, or sometimes in skins of animals partially tanned and firmly adherent. Nothing is yet known either of the plants which produce it or of the mode in which it is prepared. It presents various characters. Two sorts have been described above under the head of Socotorine aloes, to which they bear some resemblance, and with which they are at present generally confounded; but these are comparatively small in quantity. The most common of its better qualities presents a dark liver-brown colour and little lustre externally, a much paler liver-brown tint and waxy lustre on the surface of a fresh fracture, scarcely any translucency except on the mere edges, less brittleness than Socotorine aloes, and a less agreeable, though still not positively unpleasant, odour. Its powder has a golden-yellow tint. Weak spirit leaves much insoluble fleecy matter. Almost the whole of what has been sold and used in Britain for many years past under the name of Socotorine aloes has been really East-Indian aloes, or an extract from it prepared in Europe. It is a variety which is held at present in much estimation; and the superior qualities of it are probably equal to the true Socotorine sort for medical use. The inferior qualities are dark-brown, of the same tint on an old surface and on a fresh fracture, not compact, but vesicular, and of a weaker odour than the better descriptions of it.——A variety occasionally imported into Britain under the name of Mocha aloes seems, from the specimens I have examined, to be nothing else than the East-Indian sort, but generally of low quality.

4. Barbados Aloes (Aloë Barbadensis;—Hepatica Barbaden-

sis), so named from its source, the Island of Barbados, and sometimes loosely classed with the East-Indian kind under the common designation of Hepatic aloes, is at present the highest in price of the three common commercial varieties, because it is in much request for veterinary practice. Its history is better known than that of any other sort. It is prepared not only in Barbados, but likewise in other West-Indian islands. At one time it was made only from the *Aloë vulgaris, DC.*; but I am assured by various pupils from Barbados, that while this is commonly used, other species are likewise employed. It was at one time certainly an inspissated juice, as we learn from Hughes' History of Barbados, published in 1750. He says the leaves are cut in the month of March when the plants are a year old, and allowed to drain in tubs; that the juice thus obtained is boiled down in copper vessels for about five hours, until thick enough to form on cooling a mass which breaks short; and that it is then poured into gourds to harden. But the Barbados aloes of the present day is the extract of a decoction. It is made by immersing for ten minutes in boiling water the chopped leaves previously enclosed in cloths or wicker baskets—increasing the strength of the decoction with repeated supplies of chopped leaves till the water is fully charged,—then allowing the liquor to cool and the sediment to settle,—and finally evaporating the clear liquor with caution till it is concentrated sufficiently to become solid on cooling. The hot liquor is allowed to concrete in large gourd-shells, in which it is always transported to Europe. This variety may be distinguished from others by its dark brownish-black colour externally, its somewhat paler, yet still dark liver-brown tint on the surface of a fresh fracture, its dull, almost earthy lustre, its nearly complete opacity even in thin layers and on its edges, its inferior brittleness, and its strong, comparatively unpleasant odour, which has been aptly likened by some to the odour of the human axilla. Its powder has a less lively yellow colour than that of any other kind now in use; and it is pulverised with more difficulty.

5. Cape Aloes (Aloë Capensis, A. lucida of some authors), so named from the Cape of Good Hope, whence it is derived, is accurately distinguished only in English commerce. On the continent and in the United States it is generally confounded with Socotorine aloes, which it somewhat resembles. It presents essential distinctions however; and not less different is its price, for Cape aloes is commonly sold at a sixth of the price of the finer East-Indian varieties which pass for Socotorine. I am indebted to Mr John Lyell, surgeon at Newburgh, for the following account of the preparation of Cape aloes, as witnessed by him in the districts of Swellendam and George in 1845. The species used are *Aloe spicata, Aloe Africana* of Haworth, and varieties of these crossed with *A. ferox*. The juice is collected in September and October by spreading sheep-skins in hemispherical holes dug in

the ground, and piling over each a dome of aloe leaves with their cut ends inwards. The leaves are renewed when the juice has drained from them; and when the skins are full, they are properly secured, and the juice is carried home for concentration over the fire in the evening. The residual extract is finally poured into boxes, and allowed to concrete by cooling. It is often injured by want of care in conducting the evaporation.' Mr Lyell thinks that this circumstance, together with the practice of collecting the juice at the wrong season, when the periodic rains are scarcely over, will account for the present low value of Cape aloes; and that there is no reason why the drug should not be made as fine in quality at the Cape as any where else. It is imported into Britain in large quantity. The better qualities of Cape aloes have a deep brown colour externally, darker than that of any species hitherto mentioned, and exhibiting a greenish shade by reflected light,—the same tint and nearly the same depth of colour on the surface of a fresh fracture,—a high almost vitreous lustre,—much translucency in thin layers, with a yellowish-brown colour by transmitted light,—a compact structure, great brittleness, and a strong not disagreeable odour. It is easily pulverised, and its powder is bright yellow, almost like gamboge. The inferior sorts, from which the descriptions of some English pharmacologists appear to have been taken, are almost black, vesicular and opaque, occasionally vitreous, but sometimes merely waxy in lustre. When it possesses these characters it is considered by some (Guibourt) as a kind of Caballine aloes.

6. Caballine Aloes (Aloë Caballina), is a name formerly given to the most inferior of all, because it was held to be fit only for horses. Its characters clearly show that it must have been the lowest stratum in the vessels in which the better qualities were allowed to cool. True Caballine aloes possesses a dark, almost black colour, a strong, fetid, sometimes empyreumatic odour, a vesicular, bituminous appearance, and a considerable intermixture of straws, bark, sand, charcoal, and other impurities. In consequence of the frequent use of Barbadoes aloes in veterinary practice, this sort is now often purchased in retail shops under the name of horse-aloes.

Chemical History.—The chemical relations of aloes have been investigated by many chemists; but the subject is still in a confused and unsatisfactory state,—to which the uncertainty of the nomenclature and description of its several kinds may have not a little contributed. It has an intense, disagreeably bitter taste, and a strong peculiar odour, increased by breathing on it. It softens with the heat of the hand and becomes somewhat adhesive. An increasing heat causes imperfect fusion, frothing, charring, and inflammation. M. Edmond Robiquet, the last who has analysed it (1846), and who seems to have examined a fine East Indian sort, found it to consist of 8 per cent of albumen, 4.5 of various salts,

and 85 of a substance, which, in common with prior observers, he regards as its active proximate principle. This substance, called Aloësin, is obtained by adding acetate of lead to a watery solution of aloes, precipitating the filtered liquid with ammonia, washing the precipitate with boiling water, decomposing it in water with sulphuretted-hydrogen gas, but out of contact with atmospheric air, and evaporating the colourless fluid in vacuo. Aloësin thus prepared is in colourless or pale yellow scales, like a varnish, of a powerful aloetic taste, soluble in cold water, alcohol, and especially weak spirit, but sparingly in ether, and insoluble in fixed or volatile oils. Its watery solution, at first colourless, slowly becomes dark-red under exposure to the air, owing to oxidation. This change is promoted by heat [Braconnot]; and gradually a substance forms, which is without taste or odour, soluble in boiling water, insoluble in cold water, and apparently inert. The solution of aloësin is not precipitated by iron-salts, acetate of lead, isinglass-solution, or infusion of galls. Nitric acid converts it into an intensely yellow and excessively bitter substance, and a peculiar organic acid is formed, which has been variously described by different experimentalists. In the earlier inquiries of Trommsdorff, Braconnot, and Bouillon-Lagrange larger proportions of insoluble matter were found, sometimes so much as 42 per cent, apparently because inferior varieties of aloes were used for analysis. But all agree as to the tendency of exposure, heat, and moisture to convert the active principle into a dark, insoluble, and inert oxygenated extract, or apotheme.

The chemical properties and composition of aloes, though thus imperfectly known, throw some light upon the processes for preparing its pharmaceutic forms. These forms, though numerous, are referrible to the following heads,—mechanical mixtures in the solid form, decoctions, tinctures, wines, and extracts. The first, comprising the *Pills* and *Powders* of aloes, require no comment. The *Decoction* seems an unscientific form; because the active principle is apt to be converted into inert matter by prolonged heat. On the same account the Colleges properly direct that the concentration by heat shall not be carried far. This preparation cannot be kept long without undergoing decomposition. The *Tincture*, prepared as it is by all the Colleges, with a weak spirit consisting of at least two volumes of water to one of rectified spirit, is a correct preparation, which must contain the whole active ingredients, since aloësin is easily soluble in weak spirit. The *Wine* of aloes is an unnecessary form, because the solvent is substantially nothing else than a weak spirit about the same alcoholic strength with the tincture. The *Extract* is an important preparation, because at present East-Indian aloes is extensively converted into extract by wholesale dealers, especially in London, and sold under the name of purified aloes, or under the incorrect designation of Socotorine aloes. The London formula for this preparation is more

scientific than that of Dublin, inasmuch as the former recommends maceration at a gentle heat and concentration over the vapour-bath, while the latter advises that boiling water be used from the first, and that the decoction be concentrated to one-half by ebullition prior to the employment of a vapour-bath heat. In the latter way some aloësin must be converted into inert apotheme. The London College however is in error when it orders Socotorine aloes for making an extract; at least true Socotorine aloes cannot be improved by such alteration. It is more than doubtful indeed whether even the better qualities of East-Indian aloes are improved in this way; and hence the Edinburgh College has excluded the extract from its officinal preparations. The extract prepared in London is made by concentrating the fluid obtained by maceration, in copper vessels heated by steam. It has a dark brown colour, occasionally however a paler liver-brown tint; the colour of a fresh fracture is the same as that of an exposed surface; its lustre is waxy only; it has no translucency except on the mere edges; it presents some vesicular cavities; and its powder has a greenish-yellow tint. But its aloetic odour is strong.

Adulterations.—Aloes is not much subject to adulteration in the strict meaning of that term; but the inferior sorts are substituted for the superior kinds,—so prevalently indeed that custom has almost sanctioned the practice, and the designation once confined to a particular variety has been transferred, as we have seen, to another. These substitutions are to be discovered by the characters of the several denominations laid down above. It is said that liquorice-extract, gum-arabic, ochre, bone-earth, colophony and other substances are used for adulterating aloes as it is imported into Europe. But so long as cheap inferior aloes may be had for the purpose, there seems little inducement to resort to articles which may easily be detected by insolubility in weak spirit or by their odour.

Actions and Uses.—Aloes is in small doses a bitter tonic, and in doses somewhat larger a laxative cathartic. As a cathartic, it possesses the peculiar property of acting much more by exciting the peristaltic movement of the intestines, than by increasing the amount of their secretions. It also acts more peculiarly upon the large intestines, and is indeed commonly held to be without influence on the jejunum and ileum. Some conceive that it acts on the duodenum, however, and more especially on the mouths of the biliary ducts, so as to occasion an increased flow of bile. Whatever may be the fact as to this statement, aloes is well known to be one of the best substitutes for the bile, to stimulate the intestinal canal when that secretion is suspended, as in jaundice. Besides being chiefly confined in its action to the large intestines, it is also commonly thought to act peculiarly upon the rectum, and hence to occasion irritation of the anus, to irritate hæmorrhoids, to be apt even to induce them when not pre-existing, and to have a tendency

to affect the adjacent uterus sympathetically, so as to be ineligible in pregnancy, as well as after delivery. There is no question that in many individuals aloes lies under these disadvantages; but the fact is far from being so universal as is commonly believed; and when the liabilities in question do exist, they may be prevented by certain precautions in a great majority of instances. Its tendency to act unpleasantly on the uterus in the impregnated or puerperal state has led to the employment of aloes as an emmenagogue, and it is sometimes serviceable as such when used as a cathartic. Along with its action as a cathartic it possesses tonic properties, owing probably to its bitterness; and in small doses it has even been used for its tonic action alone in dyspepsia. The special applications of this drug as a laxative are unbounded. Both taken singly, and likewise united with other cathartics, it is the most important, perhaps, and the most extensively used of vegetable remedies of its class; and there is no end to the variety of cases in which it may be employed advantageously. It is peculiarly in request for correcting mere torpidity of the bowels, whether considered as a disease in itself, or occurring in connection with other chronic diseases of all kinds.

In consequence of its tendency to irritate the rectum and adjoining organs, many attempts have been made by pharmacologists to mitigate its acrimony. So far as this has been attempted by substituting decoctions for the crude drug, or by purifying it by conversion into the form of extract, great doubts now exist whether any other effect is gained than mere diminution of its energy. Particular varieties of the drug are prevalently held to be less, and others to be more, liable than the rest to act unpleasantly,—the true Socotorine aloes being considered the most eligible, and the Barbados variety the worst. This proposition too, till lately so generally admitted as to have led almost to the entire exclusion of Barbados aloes from medical practice, is now questioned by many. To me it appears that the chief difference is in the respective energy of action; that in this respect the several kinds, Barbados, East-Indian, and Cape aloes, stand in the order now given, the relation of the Socotorine kind being unknown on account of its rarity in the present day; and that by properly regulating the doses nearly the same action may be obtained from all. Such I also know to have been for some years the sentiments of many medical friends in extensive practice in this city. As to Cape aloes, though much despised in this country, it is considered a choice laxative in the United States, is often admired on the continent of Europe under the name of Socotorine aloes, and was not long ago found by Dr Pereira, on extensive trial in a London Dispensary, to differ in no respect from the others, except in being weaker. The most effectual way of counteracting the tendency of aloes to irritate the rectum is not by attempts to select a particular variety, or to modify it by pharmaceutic processes, but by combining it with other remedies. The

conjunction of other purgatives, as in the compound rhubarb pill, is often effectual; the simultaneous administration of aromatics, as in the compound powder of aloes, is likewise occasionally of service; the sulphate of iron in the form of the Edinburgh aloes and iron pill, I have frequently found to have the same beneficial effect; but the substance which possesses most remarkably this desirable property is the extract of hyoscyamus, in the dose of three or four grains with each laxative dose of aloes. It is very seldom that the combination of aloes and hyoscyamus acts disagreeably; so that it may be generally given in cases of pregnancy and even where the patient is affected with hæmorrhoids. I have met with one or two exceptions however. Certain substances have the property of increasing the action of aloes as a laxative, though not themselves cathartic. This property has been ascribed by some to several vegetable simple bitters, and especially to sulphate of quina; but I have not been able to remark it in that salt. It is undoubtedly possessed however by the sulphate of iron. One grain of aloes with two or three grains of the sulphate of iron will produce as much effect as two or three grains of aloes alone; and there is less tendency to irritation in the rectum. The Edinburgh aloes and iron pill is a preparation of this nature which will be found convenient as a tonic chalybeate laxative.—It is a singular fact that beyond a certain moderate limit the activity of aloes is not increased materially by enlarging the dose. Though apparently so powerful an agent, that two, five, or ten grains will commonly act as a cathartic, it does not seem like other active cathartics to be a poison in large doses. There are no recent inquiries on the subject; but such is the general doctrine at present.

The preparations of aloes and their doses are the following: *Aloe Socotorina*, L. E. D. gr. v. ad gr. xx. *Aloe Indica*, E.; *Aloe hepatica*, D. gr. v. ad gr. xx. *Aloe Barbadensis*, E.; *Aloe hepatica*, D. gr. ii. ad gr. vi. *Extractum aloes purificatum*, L. gr. v. ad gr. xv. *Extractum aloes hepaticæ*, D. gr. v. ad gr. xv. *Pilulæ aloes*, E. gr. x. ad dr. ss. *Pilulæ aloes compositæ*, L. D. gr. x. ad dr. ss. *Pilulæ aloes et assafœtidæ*, E. gr. x. ad gr. xv. thrice daily. *Pilulæ aloes et myrrhæ*, E. L. D. gr. x. ad ℈i. *Pilulæ aloes et ferri*, E. gr. x. ad gr. xv. *Decoctum aloes*, E. L. D. unc. ss. ad unc. ii. *Vinum aloes*, E. L. D. unc. ss. ad unc. i. *Tinctura aloes*, m. xxx. ad dr. ii. *Tinctura aloes et myrrhæ*, E.; *Tinctura aloes composita*, L. D. m. xxx. ad dr. ii. as a tonic. *Pulvis aloes compositus*, L. gr. x. ad scr. i. *Pulvis aloes cum canella*, D. gr. x. ad scr. i.

Aloes also forms a part of the Pilula colocynthidis, Pilula cambogiæ, Pilula rhei composita, Pilula colocynthidis et hyoscyami, Tinctura benzoini composita, Tinctura rhei et aloes. See *Colocynthis, Cambogia, Rheum, Benzoinum.*

ALTHÆÆ FOLIA, *E. L. D.* *Leaves of Althæa officinalis (L. W. DC. Spr.;) Marsh mallow leaves.*

ALTHÆÆ RADIX; *E. L. D.* *Root of Althæa officinalis* (*L. W. D.C. Spr.*;) *Marsh-mallow root.*

MISTURA ALTHÆÆ, E. DECOCTUM ALTHÆÆ, D.

PROCESS, *Edin. Dub.* Take of
Dried Althæa-root, four ounces;
Raisins, freed of the seeds, two ounces;
Boiling water, 5 (7 old wine D.) pints.

Boil down to three (five, D.) pints; strain through linen or calico; and when the sediment has subsided, pour off the clear liquor for use.

SYRUPUS ALTHÆÆ, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Althæa-root, fresh and sliced (bruised, L. D.) eight ounces (half a pound, D.;)
Boiling-water, four pints (old m. D.;)
Pure sugar, two pounds and a-half (two pounds, D.)

Boil the root with the water down to two pints; strain and express strongly (through calico, E.;) let the impurities subside; and dissolve the sugar in the clear liquor with the aid of heat. (Boil down to the proper consistence, E. D.)

FOR. NAMES.—*Fren.* Guimauve.—*Ital.* Malvavischio.—*Span.* Malvavisco.—*Port.* Malvaisco.—*Ger.* Gemein Eibisch.—*Dut.* Gemeene Heemst.—*Dan.* Althee.—*Swed.* Ibisk-rot.—*Russ.* Prosvirniak aptetschkoi.

FIGURES of Althæa officinalis in Hayne, ii. 25.—Nees von E. 417.—Steph. and Ch. i. 51.

MARSH-MALLOW is an article of the Ancient Materia Medica, being well ascertained to be the Ἀλθαία of Dioscorides.

Natural and Chemical History.—It is the *Althæa officinalis* of botanists,—a common inhabitant of the banks of rivers and of salt-marshes in various parts of the continent, as well as in this country. It is a perennial plant belonging to the Linnæan class and order, *Monadelphia Polyandria*, and to the *Malvaceæ* in the natural arrangement. It produces heart-shaped, downy leaves, which are strongly mucilaginous, and on that account are still retained in the British Pharmacopœias; but they are now little used. The flowers are pale red or almost white, and, like the leaves, mucilaginous. The root, the chief official part of the plant, is between twelve and eighteen inches long, about the thickness of the finger, and composed of a pale yellowish-brown thin bark and a white fibrous interior. It should be gathered in the autumn from plants at least two years old. It is usually sold in this country in pieces between three and six inches long, with the bark remaining, which in France is more correctly removed with the rasp. When thus prepared it is white, light, woolly externally, and composed of delicate silky fibres. It has a sweetish, mucilaginous taste. Cold water is rendered very ropy by it, but does not become blue with tincture of iodine. Boiling water however removes starch from it, and when cold is strongly affected by iodine. The difference between the action of cold and hot water should be attended to in making the preparations of marsh-mallow. The syrup of the British Pharmacopœias for example, which, being made with the aid of ebullition, contains the starch of the root, is a less elegant form than that used in France, in preparing which cold water only is employed, and consequently mucilage only separated. The former is more apt to spoil than the latter.

The chemical constitution of althæa-root has been of late examined carefully by several experimentalists. It contains a little starch, nearly twenty per cent of mucilage, some uncrystallizable sugar, and a crystallizable principle, besides other unimportant constituents. The mucilage lies, like the starch, in small cells, in the form of minute grains, which may be obtained pure by washing the chopped root in rectified spirit and allowing them to subside. A yellowish-white powder is thus procured, consisting of microscopic, transparent grains, which seem intermediate between true gum and perfect starch. The crystalline principle, which was discovered in 1827 by M. Bacon, and termed by him Althæin, was afterwards found by Plisson to be identical with the asparagin of asparagus, or what is now considered the aspartate of ammonia. It is most easily obtained by macerating chopped althæa-root in four parts of cold water, concentrating the filtered liquor over the vapour-bath, and exposing this to cold for some days; upon which crystals are slowly formed. It is neutral, without taste or odour, and nowise connected with the medicinal properties of the root; which depend upon mucilage and sugar.

Actions and Uses.—Marsh-mallow root is demulcent in its action and enjoys the credit of being one of the most convenient and useful remedies of the kind. In France it is in great request, both on account of its own properties, and as a mucilaginous vehicle for administering other remedies. It is freely used in diseases of the mucous membranes, hoarseness, catarrh, pneumonia, gonorrhœa, vesical catarrh, renal irritation, acute dysentery and diarrhœa,—in all of which it either acts directly by lubricating the diseased surface and blunting the acrimony of its secretions, or indirectly through its soothing influence on the alimentary canal and the transmission of that influence sympathetically to the remote organs which are affected. For these purposes nothing can be better than the simple decoction or mixture of the Edinburgh and Dublin Colleges, which may be taken at pleasure, and which corresponds with the mucilaginous *Ptisanes* prevalently employed in French practice. The syrup is also a good preparation, both in itself, and likewise as a pharmaceutic vehicle. Another favourite preparation in France is the *Pâte de Guimauve*, or lozenge, made with mucilage of althæa, gum-arabic, sugar, and white of egg.

Other species of althæa possess the same properties with the *A. officinalis*, and are sometimes substituted for it, among which may be mentioned the *A. alcea* and *A. rosea*, the holly-hock. Every part of these plants is mucilaginous. The roots however are coarser and covered with a rougher and thicker bark than the marsh-mallow.

The doses of the preparations of marsh-mallow are, *Syrupus Althææ*, E. L. D. ℥ss. to ℥i. *Mistura Althææ*, E. *Decoctum Althææ*, D. lbi. or at pleasure.

ALUMEN, *E. L.* SULPHAS POTASSAE ET ALUMINAE, *D.* *Sulphate of alumina and potash.*

TESTS, *Edin.* Not subject to adulteration.
TESTS, *Lond.* Crystalline; entirely soluble; from this solution alumina is thrown down colourless by potash or ammonia, and is redissolved by an excess of potash.

ALUMEN EXSICCATUM, *E. L.* ALUMEN SICCATUM, *D.*

PROCESS, *E. L. D.* Take any convenient quantity of Alum; fuse it over the fire in an earthen (or iron, E.) pot; continue the heat till ebullition ceases and vapour is no longer discharged; then reduce it to powder.

LIQUOR ALUMINIS COMPOSITUS, *L.*

PROCESS, *Lond.* Take of
Alum and sulphate of zinc; of each one ounce;
Boiling water, three pints.
Dissolve the salts in the water, and filter the solution.

CATAPLASMA ALUMINIS, *D.*

PROCESS, *Dub.* Take
The white of two eggs, and a drachm of alum, and agitate them together till they concrete.

PULVIS ALUMINIS COMPOSITUS, *E.*

PROCESS, *Edin.* Take of
Alum, four ounces;
Kino, one ounce.
Mix them and reduce them to fine powder.

FOR. NAMES.—*Fren.* Alun.—*Ital.* Allume.—*Span.* Alumbre.—*Port.* Pedra hume.—*Ger.* Alaun.—*Dut.* Aluin.—*Dan.* Allun.—*Swed.* Alun.—*Russ.* Kvastsi.—*Arab.* Shebb.—*Pers.* Zajbelur.—*Tam.* Paddicarum.

ALUM (Potash-alum, Sulphate, or Supersulphate of alumina and potash) was well known to the ancients; but its nature was not understood till about the middle of last century, when first Geoffroy, and then Marcgrav, distinguished alumina from other bases (Geiger.)

Chemical History.—It exists in nature as an efflorescence from some rocks and soils, chiefly in volcanic countries. It is in a great measure prepared however artificially from alum-slate,—a rock belonging to the coal formation, and containing a considerable proportion of sulphur, iron, and alumina. Sometimes by spontaneous decomposition, sometimes by the process of roasting, the sulphur and iron are oxidated; the sulphate of alumina, with some sulphate of iron, is then obtained by lixiviation, after which sulphate of potash is added to the liquid; and by repeated crystallization the alum is at last freed of adhering sulphate of iron.

Alum is usually sold in broken fragments of crystals, which are transparent, colourless, of an acid sweetish astringent taste, and slightly efflorescent in the air. It is easily crystallized in very regular octahedres or derived forms; and at Hurlet, near Paisley, which has been long celebrated for the manufacture of this salt, it is sometimes crystallized in columns two feet in length, weighing fifteen pounds, and consisting of a pile of truncated octahedres of great size. When heated, it fuses in its water of crystallization; which is afterwards disengaged, with much frothing of the salt; and at length anhydrous alum is obtained, the *Alumen exsiccatum*

of the Pharmacopœias, or burnt-alum of common speech. A stronger heat again fuses it, a part of the acid is slowly expelled, and there is left alumina and sulphate of potash. It is soluble according to Poggiale in 10·4 parts of water at 50°, and in 0·28 at 212°. The solution has an acid reaction upon vegetable colours. It is decomposed by the alkalis and soluble earths, and by soluble carbonates. It is best known by the effects of solution of potash and its carbonate. Potash precipitates the alumina in the form of white flakes, but when added in excess redissolves it. Carbonate of potash precipitates, not a carbonate, as from salts of all the other earths, but alumina only—as may be ascertained by washing away any excess of the test from the precipitate, and then effecting its solution in sulphuric acid, which is accomplished without effervescence. The solution is decomposed by various vegetable colouring matters and vegetable infusions, but particularly those which contain tannin. When alumina is thrown down from it by an alkali in a coloured vegetable solution, the vegetable colouring matter often falls down closely united with the earth. It is composed of an equivalent of alumina, an equivalent of potash, four equivalents of sulphuric acid and twenty-four equivalents of water,—more correctly speaking, of one equivalent of sulphate of potash and one of tersulphate of alumina, with twenty-four of water ($KOSO^3 + Al^2O^3\ 3SO^3 + 24\ Aq$); and consequently of 87·25 parts of sulphate of potash, 171·7 of tersulphate of alumina, and 216 of water.

Two other varieties of alum are known besides that now described. These are named Soda-alum and Ammonia-alum, because the potash of the common variety is displaced by an equivalent of soda or ammonia. They have the same crystalline form with potash-alum, and possess in other respects very similar properties. They are little met with in this country.

Adulterations.—Alum is seldom adulterated. Oxide of iron, its only occasional impurity, is detected by precipitating the solution with potash and redissolving the alumina with an excess of the alkali, upon which yellow sesquioxide of iron is left.

Actions and Uses.—Alum is an irritant in large doses, and in medicinal doses an astringent, and also, as some think, a sedative. ——It is scarcely active enough as an irritant to be considered a poison. Yet the experiments of Orfila and of Devergie show that in the dose of two ounces it will occasion death in animals if retained in the stomach by a ligature, and that large doses will also occasion fatal inflammation and suppuration if introduced into the subcutaneous cellular tissue. To this irritant action is owing the laxative property which some authors appear to have occasionally observed it to possess. Small doses long continued seem to have no cumulative effect; and hence some justify the use of it for making bread white.——Its astringent action is the best marked and most important of its effects. It powerfully corrugates the animal

fibre and diminishes vascularity where it is directly applied; results which are also propagated sympathetically to remote parts, as in the operation of other active astringents. Its medicinal uses, founded on its astringency, were at one time numerous. But in British practice they have been for some time, perhaps unjustly, more circumscribed.——Externally, alum is useful for arresting hæmorrhage. In epistaxis it is sometimes serviceable when introduced into the nostril by means of a plug soaked in a strong solution. Menorrhagia is sometimes checked in like manner by injecting a strong solution, or introducing a sponge soaked with it into the vagina. In excessive hæmorrhage from leech-bites, powder of burnt-alum, or a pointed dossil of linen steeped in a strong hot solution, will often arrest the flow of blood if thrust into the wounds. In chronic inflammation and ulcers of the fauces, and likewise in some acute inflammations of the throat, such as diphtheritis and the sore throat of scarlatina, it is a valuable local remedy either in the familiar shape of gargle, or applied to the part by blowing finely powdered burnt-alum through a tube (Bretonneau). It is thus particularly serviceable in the relaxed sore throat of professional singers (Benati). It is one of the best astringent washes for mercurial sore-mouth. In the form of burnt-alum it is an old and approved remedy for keeping down unhealthy exuberant granulations; and in the state of lotion it is often useful in cases of foul ulcers with excessive discharges. A collyrium of alum is a favourite remedy with many in ophthalmia. An alum-injection is often useful in fluor-albus and gleet. In many of its external uses alum has been displaced of late by sulphate of zinc. ——Internally, it is used for arresting hæmorrhages, such as hæmoptysis, hæmatemesis, and menorrhagia. In hæmatemesis it may be conceived to act as a local agent; but both here and in the other hæmorrhages it is more probably beneficial as a constitutional astringent. It has been likewise employed as an internal astringent in chronic catarrh, chronic diarrhœa, and dysentery. Cullen and Percival valued it highly in the chronic stage of dysentery. Some employ it likewise in colliquative sweating; and others in diabetes. During last century Grashuis, a Dutch physician, and after him Percival, recommended it strongly as a remedy for colica pictonum; and this treatment has been lately revived in France, where its effects have appeared so beneficial as to lead some to believe that the remedy combines, like the preparations of lead, a sedative with an astringent action (Pereira). Great doubts may be entertained whether the treatment of this disease by alum be equal to the common mode by alternate opiates and purgatives. It is said however to have wonderful influence in allaying tormina and sickness.——Alum, when given internally, is best administered in solution along with some distilled water, such as cinnamon-water, or with some aromatic infusion or tincture,—or in the shape of alum-whey, made with one ounce of milk for

every five grains of alum, and strained to separate the curd. Externally, it is employed as a collyrium in the proportion of four, six, or eight grains for every ounce of water or rose-water, or in the shape of the London *Liquor aluminis compositus.* As an application to ulcers, it may be used in the form last mentioned, or in that of the Dublin *Cataplasma aluminis*, made by agitating white of egg and alum together. The latter form is a good application for erythema from pressure in fever and other typhoid diseases.

The preparations and doses of alum are as follows: *Alumen*, E. L. *Aluminis et potassæ sulphas*, D. gr. x. ad gr. xxx.—in colica pictonum dr. ss. ad dr. ii. *Alumen exsiccatum*, E. L. *Alumen siccatum*, in half the doses of the crystallized salt. *Liquor aluminis compositus*, L. externally. *Cataplasma aluminis*, D. externally. *Pulvis aluminis compositus*, E. internally gr. xii. ad scr. ii. Also externally.

AMMONIACUM, *E. L. D.* *Gummy-resinous exudation of Dorema Ammoniacum, Don. Linn. Trans. xvi. (Edin. Lond.)—of Heracleum gummiferum, Willd. (Dub.) Ammoniac.*

MISTURA AMMONIACI, L. D.

PROCESS, *Lond.* Take of
Ammoniac, five drachms;
Water, one pint.
Triturate the ammoniac with the water, gradually added, till a complete emulsion be obtained.

PROCESS, *Dub.* Take of
Ammoniac, one drachm;
Pennyroyal water, eight fluidounces.
Rub the ammoniac with the water, gradually added, till a milky fluid be obtained; filter this through linen.

EMPLASTRUM AMMONIACI, E. L. D.

PROCESS, *Edin. Lond.* Take of
Ammoniac, five ounces;
Distilled vinegar, nine fluidounces, (eight *L.*)
Dissolve the ammoniac in the vinegar, and evaporate over the vapour-bath, with constant agitation, till the due consistence be attained.

PROCESS, *Dub.* Take of
Ammoniac, five ounces;
Vinegar of squill, half a pound.
Dissolve the ammoniac in the vinegar, and evaporate, with constant agitation, to the due consistence.

EMPLASTRUM GUMMOSUM, E.

PROCESS, *Edin.* Take of
Litharge-plaster, four ounces;
Ammoniac, galbanum, and bees'-wax, of each, half an ounce.
Melt the gum-resins together and strain them, melt also together the plaster and wax, add the former to the latter mixture, and mix the whole thoroughly.

EMPLASTRUM AMMONIACI ET HYDRARGYRI, E. L. D.
See *Hydrargyrum.*

FOR. NAMES. *Fren.* Gomme Ammoniaque.—*Ital.* Armoniaco.—*Span.* Goma ammoniaco.—*Ger. and Dan.* Ammoniak.—*Russ.* Ammoniac.—*Arab.* Eschak; Fooshook.—*Pers.* Ooshook; Ooshk.—*Hind.* Ooshk.

FIGURES of the plant have not yet been published.

AMMONIAC was one of the articles of the ancient Materia Medica, being mentioned both by Hippocrates and Dioscorides under the name Αμμωνιακον. Its name has been commonly derived, on the authority of Dioscorides, from Ammon, one of the titles of Jupiter, near whose temple in the Lybian desert the plant which produces it was said to grow in former times. Mr D. Don imagined the name to be rather a corruption of the word Armeniac, (Gummi-Armeniacum), and to have been used because the drug was trans-

mitted to Europe through Armenia from Persia. But it scarcely appears that the ancient Greek physicians were acquainted with the Persian variety.

Natural History.—The natural history of this drug was obscure till a recent period, but is now better understood since the botanical researches of Mr Don (Linn. Trans. xvi.) and the information supplied by various British officers of our Indian army (Calc. Med. Phys. Trans. i. and Don's paper), as well as by a French geologist Fontanier (Merat. i.), who have all lately visited the district where the gum-resin of commerce is collected. The British Pharmacopœias till of late erroneously referred it on the authority of Willdenow to his *Heracleum gummiferum.* Mr Don showed that the true source is a species belonging to a new genus, which he has named *Dorema Ammoniacum.* This is probably identical with the *Diserneston gummiferum* of Jaubert and Spach, subsequently described by them from imperfect specimens collected in Southern Persia by Aucher Eloy [Royle]. It is a herbaceous plant belonging to the natural order *Umbelliferæ*, and to the Linnæan class and order *Pentandria digynia.* It grows abundantly on arid exposed situations in the province of Irak in Persia, 42 miles south of Ispahan; on the low hills near Herat in the eastern part of Khorassan [Sir John M'Neill]; and in Syghan near Bameean on the north-west slope of the Hindoo Coosh range of mountains [Dr George Grant]. It is likewise said to grow in Barbary. Probably more plants than one have been confounded under one name. That which is found in Irak, where it is called Ooshk, has a perennial root, and pushes forth several branchy stems from four to seven feet high and about four inches in diameter. In the course of the summer, the branches and stems are pricked by an innumerable multitude of beetles; in consequence of which the juice exudes in all quarters, and concretes into tears, or falls upon the ground. In the month of July, when the plants are covered with gum, it is collected by the country people, made up into masses of agglutinated tears, and subsequently conveyed to Bushire; whence it is exported to Europe directly, or through the medium of Bombay. It farther appears that ammoniac is produced in the very same manner in dry sandy districts in the northern parts of Morocco, especially near El Araische and M'Sharrah (Jackson) from a plant called Fooshook (M'Neill); and from information communicated from Tangiers through Mr Fox Strangways Professor Lindley has been led to infer, that the plant which produces the Barbary gum-resin is a particular species, the *Ferula tingitana* of Linnæus. In Syghan as Dr Grant informed me, ammoniac is got, like assafœtida, entirely from the root of a plant called there Badra. At Herat the plant is called Kaudeel (M'Neill). It is singular that in all its Asiatic localities the assafœtida plant grows beside it.

Chemical History.—The ammoniac of the shops is imported chiefly from Bombay, but sometimes from the Levant. It occurs

at times in tears, more commonly in amygdaloidal masses composed of agglutinated tears. The tears vary in size from that of a pea to that of an olive,—they are yellowish or yellowish-red externally, and white like opal internally when the fracture is recent,—they present complete opacity and considerable hardness at ordinary temperatures, but soften somewhat with the heat of the hand,—and they possess a powerful, penetrating, peculiar odour, with a mucilaginous, bitter, acrid taste. That which occurs in lumps presents various appearances according to its quality. The better qualities form masses of a pound or more in weight, composed chiefly of the tears just described, together with a small quantity of a softer, brownish-red, connecting material of the same taste and odour with the tears themselves. In the coarser sorts the tears are fewer and the agglutinating matter more abundant; the whole mass is consequently browner and softer, sometimes even rather viscous; the odour and taste are weaker; and straws, seeds, sand, and other impurities may be detected in some specimens. The quality of ammoniac is therefore to be ascertained from the number of tears in it, their hardness, and their pure opaline-white colour, passing to pale yellowish-white under exposure to the air.

Ammoniac, like other gum-resins, is best preserved by wrapping it in clean bladders, and keeping it in tin boxes or close drawers. It cannot be pulverised except in cold weather, because trituration tends to soften it. The London Pharmacopœia follows the plan of purifying inferior varieties by softening the gum-resin with boiling-water and squeezing it through a cloth. Weak spirit has been recommended as preferable [Gobley]. But purification from foreign substances is thus accomplished at the expense of considerable diminution of its most active ingredient, volatile oil; which passes off with the watery vapour in the subsequent process of drying. All samples so impure as to require purification ought to be rejected entirely by the druggist.

Ammoniac is one of the fetid gum-resins, consisting essentially of resin, gum, and volatile oil. Heat softens, but does not fuse it. At a red heat it burns with a white flame. Water dissolves its gum; the mucilage so formed suspends the resin; and consequently an emulsion is produced without the aid of any other menstruum. In this manner is prepared the *Mistura ammoniaci* of the London and Dublin Pharmacopœias,—its best pharmaceutic form for internal use. The addition of a little acetic acid to water facilitates the formation of a smooth emulsion; and distilled vinegar is therefore used for making a uniform pulp of ammoniac, prior to converting it into a plaster. In the formula however of the Edinburgh and London Colleges, for preparing the *Emplastrum ammoniaci*, it is an error to direct that the gum-resin shall be dissolved in the vinegar, because solution in that fluid is impossible. Alcohol dissolves the resin of ammoniac and its volatile oil, together with a portion of its gum; and the solution becomes milky on the addition of wa-

ter, owing to the separation of resin. Sulphuric ether dissolves the resin and volatile oil only, leaving the gum. When water is distilled from it, a fluid is obtained which smells strongly of ammoniac; and from most samples a small quantity of volatile oil also passes over, which has an intense, penetrating odour of the same kind. Some have failed to obtain any volatile oil from it (Braconnot); but I find that a little may always be got, if the quality be good. According to the analysis of Braconnot, with which that of Hagen nearly corresponds, it consists of 70 per cent of resin, 18.4 of gum, and 4.4 of a matter like gluten, together with a little moisture. Bucholz found its composition to be 72 per cent of resin, 22.4 of gum, 1.6 of the gummy principle bassorine, together with some volatile oil.

Actions and Uses.—Like the other fetid gum-resins, ammoniac is a stimulant of the diffusible kind, and, like all such stimulants, it possesses antispasmodic properties. It was at one time also considered a deobstruent, expectorant, cathartic, diaphoretic, and diuretic. Its applications in practice were consequently extensive. At present it has gone so much out of fashion as an internal remedy, that very few can speak of its effects from personal observation. On the whole it would seem to be a good enough antispasmodic stimulant, and in that capacity useful in the milder forms of hysteria, though inferior to the allied gum-resin, assafœtida. As to its other alleged virtues they are either problematical or too feeble to deserve particular notice. It is more employed as an external stimulant than internally. It irritates the integuments, sometimes, according to Dr Duncan, even too strongly; and this property has been applied to the treatment of various indolent local diseases, such as disorders of the joints and indolent chronic bubos, as well as chronic enlargement of the external glands. There is no question that in this way absorption in the affected part is sometimes roused, and the swelling discussed. The ordinary mode of employing ammoniac for the purpose of obtaining its topical action is to apply it in the form of plaster, or in the shape of a poultice when worked into a pulp by means of vinegar.

The doses of its preparation are:—*Ammoniacum*, gr. x. to gr. xxx. *Mistura ammoniaci*, L. D. unc. ss. to unc. i. *Emplastrum ammoniaci*, externally. It is used also, in preparing the *Emplastrum ammoniaci cum hydrargyro*, E. L. D., the *Emplastrum saponis*, E., and the *Pilulæ scillæ*, E. L. D.

AMMONIAE AQUA, *E. D.* AMMONIAE LIQUOR, *L.*

Diluted aqueous solution of ammonia. Ammonia.

TESTS, *Edin.* Density 960: diluted nitric acid occasions no effervescence: when saturated with nitric acid, it is not precipitated by solution of nitrate of silver.

TESTS, *Lond.* Density 960: heat disperses it entirely in alkaline vapours, which render turmeric brown: not precipitated by lime water, nor, after saturation with nitric acid, by sesquicarbonate of ammonia, or nitrate of silver.

PROCESS, *Lond.* Take of
Hydrochlorate of ammonia, ten ounces;
Lime, eight ounces;
Water, two pints;
Slake the lime with part of the water, put it into a retort, add the hydrochlorate in small fragments, pour in the rest of the water, and distil off fifteen fluid ounces.
PROCESS, *Edin.* See *Ammoniæ aqua fortior.*

PROCESS, *Dub.* Take of
Powder of muriate of ammonia, three parts;
Fresh quicklime, two parts;
Water, ten parts.
Slake the lime with one part of water in a covered vessel, and put it into a retort; add the salt dissolved in the rest of the water heated; distil off five parts into a cool receiver. Density 950.

AMMONIAE AQUA FORTIOR, *E.* AMMONIAE LIQUOR FORTIOR, *L.* *Concentrated aqueous solution of ammonia. Strong ammonia.*

TESTS, *Edin. Lond.* Density 880° (882 at 62°, L.); one fluidounce with two fluidounces and a-half (three, L.) of water, makes the Aqua or Liquor Ammoniæ; for which other characters are given above.

PROCESS, *Edin. for both solutions.* Take of
Sal-ammoniac, thirteen ounces;
Quicklime, thirteen ounces;
Water, seven fluidounces and a-half;
Distilled water, twelve fluidounces.
Slake the lime with the water; cover it up till it cool; triturate it well and quickly with the sal-ammoniac previously in fine powder; and put the mixture into a glass retort, to which is fitted a receiver with a safety-tube. Connect with the receiver a bottle also provided with a safety-tube, and containing four fluidounces of the distilled water, but capable of holding twice as much. Connect this bottle with another loosely corked, and containing the remaining eight ounces of distilled water. The communicating tubes must descend to the bottom of the bottles at the farther end from the retort; and the bottles and receiver must be kept cool by snow, ice, or a running stream of very cold water. Apply to the retort a gradually-increasing heat till gas ceases to be evolved; remove the retort, cork up the aperture in the receiver, where it was connected with the retort, and apply to the receiver a gentle and gradually-increasing heat, to drive over as much of the gas in the fluid contained in it, but as little of the water, as possible. Should the liquid in the last bottle not have a density of 960, reduce it with some of the strong ammonia in the first bottle, or raise it with distilled water, so as to form aqua ammoniæ of the prescribed density.

LINIMENTUM AMMONIAE, L. E. D.

PROCESS, *Edin. Lond. Dub.* Take of
Olive oil, two fluidounces;
Aqua ammoniæ, D. 960, a fluidounce (two fluidounces, D.)
Mix and agitate them well together.

LINIMENTUM AMMONIAE COMPOSITUM, E.

PROCESS, *Edin.* Take of
Stronger aqua ammonia, D. 880, five fluidounces;
Tincture of camphor, two fluidounces;
Spirit of rosemary, a fluidounce.
Mix them well together.
This liniment may be also made weaker for some purposes with three fluidounces of tincture of camphor, and two of spirit of rosemary.

FOR. NAMES.—*Fren.* Ammoniaque liquide.—*Ital.* Ammoniaca liquida.—*Ger.* Wässeriges ammoniak; ammoniakflüssigkeit; Salmiakgeist.—*Russ.* Gidkvi ammiak.

AMMONIA was unknown to the ancients or earlier moderns. It was discovered in a state of solution by Black in 1756, and in the pure gaseous condition by Priestley in 1774. It is disengaged abundantly, but in union with carbonic acid, during the putrefaction or destructive distillation of most animal substances, and more sparingly in the same circumstances from some vegetable matters.

Chemical History.—It exists when pure in the state of a gas,

which is largely condensable by water, forming the solution of ammonia of the shops. Solution of ammonia is obtained for medical use from one of its salts by the process of single decomposition. Various salts answer the purpose; but the hydrochlorate, or salammoniac, as it is familiarly called, is usually preferred, because the cheapest. For the same reason quicklime is commonly chosen as the decomposing agent; though either of the fixed alkalis in the caustic state is equally effectual. The chemical changes that occur are disengagement of ammonia, and union of the hydrochloric acid with the lime. The water which is to absorb the gas in this process may be mixed with the other materials; in which case the solution of ammonia is obtained by distillation, according to the formulas of the English and Irish Colleges. Or, according to the method of the Edinburgh Pharmacopœia, the water may be put into the receiver so as to condense the ammonia as it passes over in the gaseous state; which is the only method of preparing a concentrated solution.

The Colleges, it will be observed, differ as to the relative proportion in which the lime and hydrochlorate of ammonia should be used; and the same or even a greater difference prevails in works on chemistry, whether practical or scientific. The exact decomposing proportions are one part of lime and a trifle less than two parts of hydrochlorate of ammonia (28.5 and 53.6); and a slight addition should be made to the lime by reason of its occasional impurity. As in most cases of single decomposition however the salt is found to be decomposed more quickly, and at a lower temperature, when a considerable excess is used. What that excess ought to be has not been agreed on among practical men. The Dublin College recommends for one part of hydrochlorate two-thirds of lime; the London College four-fifths; the Edinburgh College, the Parisian Codex, and Dr Turner, one part; Geiger and Liebeg five-fourths; the former Edinburgh Pharmacopœia one part and a half, and Berzelius two parts. The probability is that the advantages of a large excess have been overrated, and in particular that a moderate excess is sufficient when the solution is obtained by distillation, as in the London and Dublin processes.

The method by distillation has the advantage of requiring less heat than the other, and of saving the operator from the irritating ammoniacal fumes which are discharged when lime and hydrochlorate of ammonia are mixed together before being introduced into the retort. It is impossible, however, to obtain in this way a very strong solution. And although the London and Dublin Colleges have waived this difficulty,—the latter, by declining to recognize any stronger solution than one of the density 950, and the former, by adopting the strong commercial ammonia of the manufacturer among the articles of the materia medica, without a process for preparing it,—there can be no doubt, that a concentrated solution must be admitted, since every druggist uses it, and consequently

that a process for it is just as necessary as for the weaker form. The Edinburgh formula therefore on this ground alone seems preferable to that of the other colleges. I have found it an exceedingly convenient method of obtaining a solution of ammonia of both the standard strengths in one operation, and without any material loss. It is more economical than the other College processes. The product of the London formula, according to Davy's table, page 105, accounts for only 42 per cent of the ammonia in the hydrochlorate. The product of the Dublin formula accounts for 66 per cent. In the last edition of this work the product of the Edinburgh process was stated to be 82 per cent, without including the impure ammoniacal liquor in the first receiver. A criticism of Mr Phillips however satisfies me that in stating the results of my trial some numerical error was committed, which I cannot now trace out. But Dr Maclagan, on repeating the process, has obtained in the last two receivers 70 per cent of the ammonia in the decomposed salt. It is not easy to account for the enormous waste in the London process.

In conducting these processes various minutiæ must be attended to for ensuring a uniform product. The materials should be put into the retort soon after being mixed, as ammonia immediately begins to be evolved. When introduced in the dry state they must first be very thoroughly mixed, otherwise the hydrochlorate of ammonia may in part escape decomposition. As the trituration necessary for this purpose causes on the large scale both loss and annoyance from the escape of ammonia, it has been proposed in large operations to mix finely-powdered sal-ammoniac with the lime in its unslaked condition and in coarse fragments, to put the mixture into the retort, and to add from time to time by a safety-tube a sufficient quantity of water to slake the lime. The heat thus produced expels a considerable part of the ammonia, and the rest is subsequently driven over by applying heat below in the usual manner (Mitscherlich). When the London method by distillation is followed, there is some advantage in putting part of the water into the receiver to condense the undissolved ammonia which passes over at the commencement. In the method by absorption of the gas, followed by the Edinburgh College, it is necessary to have the second receiver twice as capacious as the volume of water put into it; because, when fully charged with ammonia, the water occupies a considerably larger space. With every method, but especially with that by absorption, it is essential that the receivers be kept very cool; for as the water readily heats from condensation of the gas, it will speedily part again with much of the absorbed ammonia, if it be not constantly and effectually cooled.——The residuum, when subsequently urged with a stronger heat in a crucible, so as to decompose or drive off any undecomposed sal-ammoniac, contains chloride of calcium with an excess of lime, and may be made to yield the former by lixiviation and evaporation of the filtered fluid

Ammonia is permanently gaseous under ordinary atmospheric temperatures and pressures; but at 50°, and under a pressure of six atmospheres, Mr Faraday has shown that it is condensed into a colourless, very mobile liquid, of the density of 760. The density of the gas is 0.591. It has a highly pungent, suffocating odour, is irrespirable, and irritates and inflames the animal textures. It is with difficulty inflammable. It turns reddened litmus purple, turmeric brown, and blue cabbage green; and its effects on the last two substances disappear under heat or exposure to the air. By electricity or transmission through a red-hot tube it is resolved into three equivalents of hydrogen gas and one equivalent of nitrogen [$N H^3$]. It combines readily with acids and forms crystallizable salts, which by heat are all either sublimed or decomposed,—those with volatile acids being sublimed without change, while those with fixed acids part with their ammonia. When it comes in contact with a gaseous acid, the two gases are solidified in uniting, and form a white, sometimes crystalline powder. It is freely absorbed both by water, and by alcohol, but especially by the former; which has so great an affinity for it as to rush into a tube filled with the gas almost as it rushes into a vacuum. Water at the temperature of 59° F. and at the atmospheric pressure of thirty inches absorbs 670 times its volume of ammonia (Davy); but results somewhat different have been obtained by different chemists. The solution variously diluted constitutes the *Aqua* or *Liquor Ammoniæ* of the Pharmacopœias, often incorrectly called liquid Ammonia, Hartshorn, or spirit of Hartshorn.

Solution of ammonia is a transparent, colourless fluid, of an acrid alkaline taste, and overpowering pungent ammoniacal odour. Its density when completely concentrated is stated by Dalton at 850, by Sir H. Davy at 872, but is very troublesome to determine on account of the rapid escape of the gas. I believe it to be little under 880; for water saturated with ammonia at 50° gives off numerous visible globules of gas in rising to 60°, and then marks 880, though the escaping gas be confined over it. It freezes towards the freezing point of mercury. A solution saturated at 32° seems to boil at 50°; when of the density 910, at 112°; and at 130° when diluted to the density of 936. But the apparent ebullition is occasioned by the escape of gas chiefly. When exposed to the air, it quickly parts with ammonia and also absorbs carbonic acid; so that it must be kept in well-closed bottles. It unites with oils to form soaps or liniments, of which one made with olive oil is the officinal *Linimentum ammoniæ*. It decomposes most earthy and metallic salts, throwing down their oxides; but frequently a portion of ammonia combines with the precipitated oxide; and sometimes an excess of the ammonia redissolves it, and produces a double salt. It may be easily known from all other liquids by its odour and by not effervescing with diluted acids; the latter of which characters distinguishes it from the solution of carbonate of ammonia. The strength of a solution may be judged of by its density; for which

purpose tables have been constructed by Sir H. Davy and Dalton. As these tables differ somewhat from one another they are both here given.

Davy's Table of the Percentage of Ammonia by weight at 59° F.

Density.	Ammon. in 100.	Density.	Ammon. in 100.	Density.	Ammon. in 100.
872.0	32.5	932.6	17.52	957.3	10.82
887.5	29.25	938.5	15.88	959.9	10.17
900.0	26.0	943.5	14.53	961.9	9.6
905.4	25.37	947.6	13.46	969.2	9.5
916.6	22.07	951.3	12.40	971.3	7.17
925.5	19.54	954.5	11.56		

Dalton's Table of the Percentage of Ammonia; the volumes of Gas in one of liquid; and the boiling point.

Density.	Ammon. in 100.	Vols. of gas.	Boiling point.	Density.	Ammon. in 100.	Vols. of gas.	Boiling point.
850	35.3	494	26° F.	930	15.1	211	122° F.
860	32.6	456	38	940	12.8	180	134
870	29.9	419	50	950	10.5	147	146
880	27.3	382	62	960	8.3	116	158
890	24.7	346	74	970	6.2	87	173
900	22.2	311	86	980	4.1	57	187
910	19.8	277	98	990	2.0	28	196
920	17.4	244	100				

Two solutions of ammonia, differing in strength, are in current use in this country; and these have therefore been properly adopted by the Colleges of London and Edinburgh. One is the concentrated solution at the temperature of 60°, which is principally used for making mixtures for inhalation against fainting and the like. The other, which is about a third of the strength of the former, is intended for general medicinal purposes. The density of the former is stated by the Edinburgh College at 880, by that of London at 882; but in fact it is rarely so strong, because, though of that degree of concentration at first, it cannot be poured from one vessel to another, or kept, unless during winter and in very well-closed bottles, without parting with some of its ammoniacal gas; and hence the commercial *Aqua ammoniæ fortior* commonly ranges between 886 and 910. This kind must be kept with great care, especially in summer; and in making use of considerable quantities of it, precautions must be observed against inhaling its fumes, which are very annoying and may prove dangerous. The weaker solution of ammonia of the density 960 may be made at once from the stronger by adding distilled water to it. The Edinburgh College directs two volumes and a-half of water to be used. The London College by mistake orders three.

Adulterations.—The chief adulterations of ammonia are with carbonic acid, water, or hydrochlorate of ammonia. Water is discovered by the increased density; carbonic acid by the solution effervescing when supersaturated with diluted nitric acid; and hydrochlorate of ammonia by the action of nitrate of silver after the addition of an excess of nitric acid. The first of these adulterations is commonly the result of fraud, the second of careless keeping, and the third of unskilful preparation. The London College also provides for other impurities, which however are seldom, if ever present: The sesquicarbonate of ammonia, after the Liquor ammoniæ has been neutralized with nitric acid, will indicate any earthy impurity by occasioning a white precipitate of carbonate. Lime-water recommended as an additional test by the same College throws down a white precipitate if any of the ammonia be carbonated. Ammonia appears sometimes to have been manufactured by direct rectification of coal-gas liquor, and it then contains pyrrol, naphthaline, and other soluble impurities. This kind is known by nitric acid reddening it, and by the fluid, when supersaturated with muriatic acid, tinging a slip of clean fir wood of a rich purple colour [Maclagan.]

Actions and Uses.—The solution of ammonia, as well as the gas itself, is a powerful irritant and narcotic poison, which in large doses occasions tetanus and coma, and in less quantity inflammation or corrosion. As a corrosive and irritant it may be used to produce on the external parts of the body redness, vesication, ulceration, or an eschar, according to its strength or the duration of its contact. Its antidote as a poison is vinegar, lemon-juice, citric acid, or tartaric acid. In medicinal doses it is an energetic stimulant, especially of the nervous system, prompt, diffusible and transient; and hence it is also an excellent antispasmodic. It is farther held to be a diaphoretic and sudorific, a diuretic also, and an emmenagogue; and it possesses antacid properties. As an external irritant it is much employed in the way of friction in cases of chronic rheumatism, and other local inflammations without fever; for which purpose it is usual to unite it with oily matters, as in the *Linimentum ammoniæ*, or with tincture of camphor, as in the Edinburgh *Linimentum ammoniæ compositum*, because it is otherwise apt to be dispersed by reason of its volatility. The former preparation is a mild rubefacient; the latter is of two strengths, and one is a powerful rubefacient, while the other will cause blistering or excoriation, if long or often applied. A good blistering ointment, which acts in ten minutes, is made by heating together 32 parts of lard, and 2 of almond oil, and shaking this mixture with 17 of solution of ammonia in a wide-mouthed bottle, until the whole becomes cool [Goudret.] Ammonia is not now used outwardly for producing any farther effect than redness or vesication. Its principal applications as an internal remedy are in the removal of fainting and asphyxia, for which its vapour is commonly snuffed up the nostrils,—as a stimulant in typhoid fever, palsy connected with

exhaustion, advanced bronchitis, or other affections at large concurring with a state of great nervous depression,—and as an antispasmodic in hysteria; for all of which purposes it is usually given rather in the form of Spirit of ammonia or in that of Carbonate than in the state of solution in water. Some give it also internally as a diaphoretic and sudorific even in the febrile phlegmasiæ; in which it is held by some continental physicians to possess the advantage of not stimulating the circulation. But this effect is perhaps more safely and as effectually attained with some of the ammoniacal salts, more especially the acetate. It is probably the best antidote for poisoning with hydrocyanic acid, and is also one of the remedies trusted to by some for the effects of the bite of venomous snakes. When used internally as a stimulant it must be given repeatedly at short intervals, if its action is to be maintained; for its stimulus, though powerful, is evanescent. It should be administered with aromatics or in the form of some of the compound ammoniacal aromatic tinctures mentioned under the head of *Spiritus ammoniæ;* and these must of course be sufficiently diluted. When to be used in the way of inhalation for fainting and the like, it is best kept in a bottle containing either fragments of carbonate of ammonia moistened with the concentrated solution of ammonia, or the latter alone with asbestus. In employing such bottles care must be taken not to hold them too assiduously or too often to the nostrils; especially if the patient remain for a time insensible to its action, for it may excite, as actually has happened in not a few instances, either a severe attack of tracheal and bronchial inflammation, or speedy death amidst tetanic spasms and coma.——The solution of ammonia is one of the most important agents in chemical pharmacy both as a test, and for making other preparations.

Its forms and doses are, *Aqua ammoniæ fortior*, E. L. externally or by inhalation. *Aqua ammoniæ*, E. L. D. min. xx. ad min. xxx.; *Ammoniæ spiritus* (see that article;) *Linimentum ammoniæ*, E. L. D. and *Linimentum ammoniæ compositum*, E. externally; *Linimentum camphoræ compositum*, externally (See *Camphora.*) *Tinctura ammoniæ composita*, L. min. x. ad min. xl.

AMMONIAE ACETATIS AQUA, *E. D.* AMMONIAE ACETATIS LIQUOR, *L.* *Diluted aqueous solution of Acetate of Ammonia.*

TESTS, *Edin.* Without action on litmus; density 1011·; free of colour or odour; solution of potash disengages an ammoniacal, sulphuric acid an acetous, odour; unaffected by solution of nitrate of silver.

TESTS, *Lond.* It is not coloured by hydrosulphuric acid, and not precipitated by nitrate of silver or chloride of barium. The residuum after evaporation is dispersed by heat, giving off ammonia.

PROCESS, *Edin.* Take of
Distilled vinegar, from French vinegar in preference, twenty-four fluidounces;
Carbonate of ammonia one ounce.
Mix them and dissolve the salt. If the solution has any bitterness, add by degrees a little distilled vinegar till that taste be removed. The density of the distilled vinegar should be 1005, and that of the Aqua Acetat. Ammoniæ 1011.

PROCESS, *Lond.* Take of
Sesquicarbonate of ammonia, four ounces and a half or a sufficiency;
Distilled vinegar, four pints.
Add the sesquicarbonate to the distilled vinegar till it be saturated.

PROCESS, *Dub.* Stir carbonate of ammonia with about thirty parts of distilled vinegar, adding gradually to saturation, as ascertained by litmus.

FOR. NAMES.—*Fren.* Acetate d'ammoniaque liquide.—*Ital.* Acetato d'ammoniaca.—*Ger.* Essigsaures ammoniak-flüssigkeit; Minderer's Geist.

THE SOLUTION OF ACETATE OF AMMONIA was first prepared by Boerhaave in 1732, and was soon afterwards brought into great notoriety by Minderer; after whom it is still generally called Mindererus' Spirit.

Chemical History.—The acetate of ammonia being an exceedingly deliquescent salt, the Colleges direct that it shall be prepared and kept for use in a state of solution. In some continental Pharmacopœias, especially those of Germany, a solution of considerable strength is used, having a density of 1030 or 1040; and Minderer made use of one much stronger still. A strong solution however is inconvenient in prescribing; and therefore the British Colleges have always used it in a diluted state, such as may be obtained by neutralizing distilled vinegar. The process for preparing it is one of simple decomposition, the acetic acid displacing the carbonic acid of the carbonate of ammonia. The Spirit of Mindererus should always be made with distilled vinegar, and not, as many druggists are in the practice of doing, with pyroligneous acid sufficiently reduced; for when made in the latter way its taste is more disagreeable, and it is more apt to spoil. Care should be also be taken that the distilled vinegar is of the correct standard strength. In this respect the formulas of the Edinburgh and Dublin Colleges, which prescribe a density of 1005, are the most precise. It will be apparent from what has been said under the head of Acetic acid that, as vinegars differ exceedingly in point of strength, so may distilled vinegars, unless attention be paid to correct the product according to its density. Distilled vinegar, taken just as distilled, will be found to be occasionally three times as strong as in other samples. Of course the strength of the solution of acetate of ammonia would vary in like measure. This is a consideration not always borne in mind by druggists; and hence in my opinion the irregularity complained of by many practitioners in the effects of the solution.

It will be seen that the Colleges differ as to the quantity of carbonate of ammonia required to saturate the acid. The formulas of Edinburgh and Dublin are nearly concordant, and, according to my observation, exact. That of London directs more carbonate of ammonia to be used. The reason is that the London College appears to have contemplated the introduction of a stronger distilled vinegar than the sister Colleges;—but one, which, as explained under the head of Acetic acid, is stronger than the generality of vinegars will yield. It may be farther added that if the Lon-

don College be right in the saturating power ascribed to its distilled vinegar as determined by carbonate of soda [p. 4], the proportion of sesquicarbonate of ammonia recommended in the present process must be wrong. If thirteen grains of carbonate of soda neutralize a hundred grains of the London distilled vinegar, then four ounces and a half of sesquicarbonate of ammonia are more than enough to saturate four pints of it.

The solution of acetate of ammonia is easily known by sulphuric acid disengaging an acetous, and caustic potash an ammoniacal, odour. Solution of sulphate of iron renders it reddish-brown. It is transparent and colourless, has scarcely any odour, and a faint mawkish saline taste, which is covered in a great degree by sugar. It is apt to spoil, unless kept in well-closed phials, in which case it may be preserved for years unchanged. By evaporation in vacuo crystals may be obtained, which are exceedingly deliquescent.

Adulterations.—It does not appear liable to adulteration, although the Colleges have annexed the requisite tests for detecting copper, lead, and sulphuric or muriatic acid,—the first two of which are indicated by sulphuretted-hydrogen occasioning a black precipitate, the third by nitrate of baryta causing a white precipitate, and the last by the nitrate of silver throwing down also a white precipitate. But though seldom adulterated, the solution of acetate of ammonia is often very faulty in respect of its strength, being sometimes too weak, but more generally too strong. The London College has not provided against this error; yet it is an important one, for a full dose of too strong a solution may cause sickness and even vomiting. The density, as stated in the Edinburgh formula, is a sufficient check. Dr Barker has stated the density of the Dublin solution at 1011, which corresponds nearly with my own observations. Sometimes the alkali is not thoroughly neutralized, which is ascertained by litmus-paper, or by the bitterish taste of the liquid.

Actions and Uses.—The ascertained actions of acetate of ammonia are diaphoretic and diuretic; but it is also considered by some to be a stimulant of the circulation, and a sedative in respect of the uterine system. In large doses it probably possesses the narcotic-irritant properties of the other neutral ammoniacal salts. In medicinal doses it is a very certain and efficient diaphoretic in all slighter febrile disorders; its action on the skin has been commonly supposed to be attended with a stimulant effect on the circulation; but my own observation would lead me to doubt this doctrine; and at all events its diaphoretic and ultimate sedative effects in febrile affections are out of all proportion great compared with any primary excitement it may occasion. It is not used as a diuretic, but appears to possess that action as well as other alkaline acetates. Some use it as a sedative and calmative in painful menstruation; and not long ago it was proposed as a remedy for dispelling intoxication. Its chief employment

in this country is as a diaphoretic in catarrhal and febricular affections; in which it is a remedy of acknowledged efficacy, and in universal use. The dose should be half an ounce for an adult every two or three hours; and the best way of administering it is to mix each dose with a little water to make up a wine glassful, and to dissolve a bit of sugar in the mixture. In this way it seldom occasions sickness. Many physicians err in prescribing it in too small doses.

The doses of its only officinal form, the *Aqua acetatis ammoniæ*, are dr. ii. ad unc. i.

AMMONIAE BICARBONAS, *D.* *Bicarbonate of ammonia.*

PROCESS, *Dub.* Transmit to saturation through the Aqua carbonatis ammoniæ a stream of carbonic acid gas evolved from the solution of marble in diluted muriatic acid: Let it rest to crystallize: dry the crystals without heat, and keep them in close vessels.

THIS salt, which is admitted by the Dublin College alone, seems an unnecessary addition to the Pharmacopœia. Its formation according to the College process is favoured by pressure. It is deposited usually in six-sided prisms, the primary form of which is a right rhombic prism. It is permanent in the air, free of ammoniacal odour, and of a slight saline taste, not ammoniacal. It is composed of one equivalent of ammonia, two of carbonic acid, and two of water ($NH^3 + 2\ CO^2 + HO$); that is 17.15 of base, 44.24 of acid and 18 of water. Or, according to the new theory of the constitution of the ammoniacal salts, it is a compound of one equivalent of oxide of ammonium, two of carbonic acid and one of water ($NH^4\ O + 2\ CO^2 + HO$). It is soluble in eight parts of temperate water. Heat applied to its solution drives off carbonic acid and then some ammonia; and consequently it must be dissolved without heat, or in tepid water. Like the sesquicarbonate of ammonia, it does not precipitate magnesia from its solutions.

Little is known of the actions of this salt. It must be a good antacid, is probably diaphoretic, and may be used to form effervescing draughts. But one cannot well see how it should be a convenient mode of administering large doses of ammonia, as some have alleged; for the powerful stimulating and antispasmodic properties of ammonia are lost, in the same manner as its remarkable sensible qualities are destroyed, by thorough saturation with carbonic acid.

Its dose is grs. v. ad grs. xxv.

AMMONIAE CARBONAS, *E. D.* AMMONIAE SESQUICARBONAS, *L.* *Sesquicarbonate of ammonia. Carbonate of ammonia.*

TESTS, *Edin.* Heat sublimes it entirely: a solution in water, treated with nitric acid in excess does not precipitate with solution of nitrate of baryta or nitrate of silver.

TESTS, *Lond.* Translucent in mass, but falls to powder in the air; entirely vaporizable

and soluble ; changes the colour of turmeric ; when saturated with nitric acid it does not precipitate with chloride of barium or nitrate of silver.

PROCESS, *Edin. Lond.* Take of
Sal-ammoniac (hydrochlorate of ammonia, L.) one pound ;
Chalk, one pound and a-half.
Reduce them separately to fine powder ; mix them thoroughly, and subject the mixture in a retort with a proper receiver to a gradually-increasing heat so long as any vapours sublime.

PROCESS, *Dub.* Take of
Well-dried powder of muriate of ammonia, and dried carbonate of soda, one part of each ; mix them, and sublime the carbonate of ammonia from an earthen retort with a gradually-increasing heat into a receiver kept cool.

LIQUOR AMMONIAE SESQUICARBONATIS, L.
AQUA AMMONIAE CARBONATIS, E. D.

PROCESS, *Edin. Lond. Dub.* Dissolve four ounces of carbonate (sesquicarbonate, L.) of ammonia in a pint (fifteen times its weight, D.) of distilled water. The density of this solution is 1090, *Dub.*

LINIMENTUM AMMONIAE SESQUICARBONATIS, L.

PROCESS, *Lond.* Agitate together three fluidounces of olive-oil and one fluidounce of the Liquor ammoniæ sesquicarbonatis.

FOR. NAMES.—*Fren.* Carbonate d'ammoniaque.— *Ital.* Carbonato d'ammoniaca. —*Ger.* Kohlensaures ammoniak.—*Russ.* Uglekisloi ammiac.—*Tam.* Navachara acranum.

THE SESQUICARBONATE OF AMMONIA (Sal volatile, Hartshorn salt, Carbonate of ammonia, Sub-carbonate of ammonia) was probably not unknown to the Arabian physicians, and was obtained from urine by Reymund Lully in the thirteenth, and with potash from sal-ammoniac by Basil Valentin in the fifteenth century (Geiger). It is produced by the decay of some vegetable substances, and by the putrefaction or destructive distillation of most animal matters.

Chemical History.—The salt used in medicine is generally obtained through the mutual decomposition of sal-ammoniac and carbonate of lime, aided by heat. The Dublin College has substituted the carbonate of soda for the carbonate of lime, but without any advantage; and some manufacturers use, instead of sal-ammoniac, the crude sulphate of ammonia, which yields a less pure product. A difference of opinion prevails as to the best proportions of the materials. The last Latin edition of the Edinburgh Pharmacopœia recommends two parts of carbonate of lime for one of sal-ammoniac, which is nearly in the ratio of two equivalents of the former to one of the latter; and among others, Geiger has lately preferred this proportion. In the new editions of the London and Edinburgh Pharmacopœias the quantity of carbonate of lime is reduced by one-fourth, that is to one equivalent and a half. And the Dublin College, as well as the new Parisian Codex, prefers equal parts, or nearly one equivalent of each. The quantity of carbonate of lime absolutely required to decompose the muriate of ammonia is only one equivalent, or in exact numbers 50.72 of the former for 53.57 of the latter; and however much carbonate of lime may be used, there is never more than this proportion decomposed. But

at the same time it is advisable to use more carbonate of lime than is theoretically sufficient, partly to ensure the contact of the whole sal-ammoniac with the decomposing agent, and partly because the action goes on at a lower temperature. A heat considerably short of redness is high enough to render the decomposition complete. The changes that ensue are peculiar: mutual decomposition takes place, chloride of calcium is left, and a carbonate of ammonia sublimes; but a portion of the ammonia passes off in the free state, and the substance obtained by sublimation is a hydrated sesquicarbonate of ammonia, not a neutral carbonate. These changes will be most easily comprehended if the two compounds be conceived to be decomposed in the proportion of three equivalents of each ($3NH^3 + 3HCl$ and $3CaO + 3CO^2$). The three equivalents of chlorine and the three equivalents of calcium unite to form three of chloride of calcium; three of hydrogen in the hydrochloric acid and three of oxygen in the lime produce three of water; three of carbonic acid in the carbonate of lime unite with two of ammonia and two of water to constitute one equivalent of sesquicarbonate of ammonia; and thus one equivalent of ammonia and one of water are set free ($2\,NH^3 + 3\,CO^2 + 2\,HO = 1$ sesquicarbonate of ammonia;—$NH^3 = 1$ ammonia;—$HO = 1$ water). No increase of the proportion of carbonate of lime will increase the proportion of sesquicarbonate of ammonia formed; for such a result, it is plain, would involve the conversion of some of the carbonate of lime into free lime. As a considerable quantity of free ammonia must therefore be discharged, it is right in manufacturing carbonate of ammonia on the large scale to condense what escapes in water, and turn it to account in making other ammoniacal preparations.

The sesquicarbonate of ammonia is usually met with in translucent fibrous masses, of a powerful ammoniacal odour, and a strong, alkaline and ammoniacal taste. Under exposure to the air it gradually becomes opaque and falls to powder, free ammonia, or, according to some, neutral carbonate of ammonia, is disengaged, and bicarbonate of ammonia is left. Heat sublimes it entirely, and in close vessels without change. It is soluble, according to Berzelius, in two parts of temperate, and in less than one part of tepid, water; but in boiling water it is decomposed, and ammonia escapes. A weak aqueous solution constitutes the *Aqua carbonatis* or *sesquicarbonatis ammoniæ* of the pharmacopœias. This is best known, in part by its ammoniacal odour, and partly by the solution of sulphate of zinc throwing down a white precipitate of carbonate of zinc, with some effervescence from the escape of the excess of carbonic acid. It forms with oils ammoniacal soaps, of which the London *Linimentum sesquicarbonatis ammoniæ* is an instance. The salt is freely soluble in proof-spirit, but very slightly so in rectified spirit. It consists as stated above of two equivalents of ammonia, three of carbonic acid, and two of water; that is 34.3 base, 66.36 acid, and 18 water. According to the new doctrine as to the constitution of am-

moniacal salts, it consists of two equivalents of oxide of ammonium and three of acid $(2NH^4O + 3CO^2)$.

Adulterations.—It is seldom adulterated. The Edinburgh and London Colleges have guarded against the presence of fixed or insoluble impurities, but especially of sal-ammoniac, or sulphate of ammonia, which are indicated, the former by nitrate of silver, the latter by nitrate of baryta, causing a white precipitate after neutralization of the solution with nitric acid. These salts may be present from faulty preparation of the carbonate.

Actions and Uses.—In its actions and uses the sesquicarbonate of ammonia corresponds with ammonia itself. It is, like solution of ammonia, a powerful narcotico-irritant poison in large doses, and in small doses an energetic, diffusible stimulant and antispasmodic. Under the trite name of smelling salts it is in constant use as a remedy for fainting, for which purpose it is aromatized with a mixture of essential oils and strengthened by adding a little of the strongest solution of ammonia to it. It is also used as a powerful stimulant in the advanced stages of the typhoid form of continued fever and other febrile diseases. It may be used instead of other alkaline carbonates as an antacid. Abroad it is sometimes employed as an emetic in the dose of thirty or forty grains. Occasionally it is used instead of the carbonates of the fixed alkalis for making effervescing powders. Thirty grains of tartaric acid neutralize about twenty-three and a half of sesquicarbonate of ammonia. Many make use of it as an external counterstimulant for exciting redness or some degree of vesication. The best way to cover its disagreeable taste is to give it along with a little syrup. It is an important test in pharmaceutic chemistry, and a useful agent for preparing various chemical compounds.

Its preparations and their doses are as follows: *Sesquicarbonas ammoniæ*, L. *Carbonas ammoniæ*, E. D. gr. v. ad xx.—*Liquor ammoniæ sesquicarbonatis*, L. *Aqua carbonatis ammoniæ*, E. D. min. xxx. ad fl. dr. j. *Linimentum ammoniæ sesquicarbonatis*, L. externally. The last is an unnecessary preparation, so long as there is a *Linimentum ammoniæ*.

AMMONIAE MURIAS, *E. D.* AMMONIAE HYDROCHLORAS, *L.* *Hydrochlorate of ammonia. Sal-ammoniac.*

TESTS, *Edin.* Not liable to adulteration.

TESTS, *Lond.* The crystalline salt is translucent, entirely vaporizable and entirely soluble, slightly reddens litmus, gives off ammonia when treated with potash or lime, and is not precipitated by chloride of barium.

FOR. NAMES.—*Fren.* Hydrochlorate d'ammoniaque ; Chlorhydrate d'ammoniaque ; Sel-ammoniac.—*Ital.* Sal-ammoniaco ; Idroclorato d'ammoniaca.—*Span.* Sal armoniaco.—*Ger.* Salmiak ; Salzaures ammoniak.—*Dan.* Salmiaken.—*Russ.* Solekisloi ammiak.—*Arab.* Urmeena.—*Pers.* Nowshader.—*Tam.* Navacharum.

THE HYDROCHLORATE OR MURIATE OF AMMONIA, before the re-

form of chemical nomenclature, had been long known by the name of Sal-ammoniac, because it was believed to have been first obtained from the neighbourhood of the Temple of Jupiter Ammon in Northern Africa. It seems to have been known to the ancient Egyptians. It is a natural production, being found at and near volcanos; and the salt of commerce has even been sometimes derived from this source, as from Mount Etna and the volcanic districts in the centre of Asia. (Guibourt.)

Chemical History.—At present muriate of ammonia is prepared in most European countries by decomposing the sulphate of ammonia with common salt. The sulphate of ammonia is obtained from various sources; sometimes by lixiviating the soot of coal, sometimes by decomposing with sulphuric acid the ammoniacal salts contained in the watery fluid which is formed in manufacturing coal-gas, and sometimes by decomposing with sulphate of lime or sulphate of iron the impure carbonate of ammonia produced by the destructive distillation of animal refuse, but more especially in the preparation of animal charcoal from bones. The greater part of the salt of commerce is made in the last of these ways. Bones, horns, and other refuse are heated in iron cylinders, and an impure carbonate of ammonia obtained by passing the vapours and gases through successive quantities of water. A brown fetid ammoniacal liquor is thus procured; and the carbonate of ammonia contained in it is converted into sulphate either by mixing with it the sulphate of iron, or by repeatedly filtering it through sulphate of lime. The sulphate of ammonia is next converted into the hydrochlorate by the process of double decomposition by muriate of soda, and then obtained in an impure state by evaporation and crystallization, as it crystallizes before the sulphate of soda which is also formed. It is then purified by sublimation. Formerly Europe was supplied chiefly from Egypt, where the salt is obtained by subjecting to sublimation the soot of chimneys, in which camel's dung is used as fuel.

The hydrochlorate of ammonia is sold in thick cakes, convex on one surface, concave on the other, of a fibrous texture, colourless and translucent, permanent in the air, tough so as even to yield to the hammer, destitute of odour, but of a pungent, acrid, saline taste. Its density is about 1450. It crystallizes in cubes, octaedres, or six-sided pyramids grouped in feathery masses. Heat sublimes it without change and without previous fusion. It dissolves freely in water, less so in rectified spirit, sparingly in alcohol. Water at 60° dissolves rather more than a third of its weight of the salt; and the solution is accompanied with a great degree of cold. Two ounces avoirdupois dissolved with five of nitre in sixteen fluidounces of water will reduce the temperature of the water by 40 degrees (Walker). At 212° water dissolves its own weight of muriate of ammonia. The solid salt, as well as its solution, gives off ammonia when acted on by caustic alkalis or lime. It was once

supposed to be a hydrated salt, but is now known to be anhydrous, and to consist of equal volumes of ammoniacal gas and hydrochloric acid gas, that is one equivalent of each [$NH^3 + HCl$], or 17.15 of ammonia and 36.42 of acid. According however to the new view taken of the constitution of the ammoniacal salts, it is the protochloride of ammonium (NH^4Cl).

Adulterations.—The salt usually sold in the druggists' shops of this country is extremely pure. My attention has not been drawn to any particular adulteration of it. Accordingly the Edinburgh College has not given any test of its purity. Among the characters given by the London College, its complete sublimation by heat, and the nonaction of chloride of barium, proving the absence of sulphate of ammonia, are the only tests for impurities, the others being merely criterions of its nature.——A commercial variety of hydrochlorate of ammonia mentioned by continental writers, and signalized by them as an impure salt, but which is never seen in this country, is the crystallized salt obtained by running its concentrated solution into conical, sugar-loaf moulds. This sort has never been sublimed, and may contain both chloride of sodium and sulphate of ammonia,—which may be detected, the former by sublimation, the latter by a salt of baryta applied to the solution.

Actions and Uses.—The actions of hydrochlorate of ammonia have been little investigated in Britain, where it is used only as an external remedy. But upon the continent, and especially in Germany, it is much prized as a sedative, refrigerant, laxative, diaphoretic and diuretic,—properties which associate it with the acetate of ammonia.—In large doses it acts as a narcotico-irritant, producing inflammation of the alimentary canal, and also, like the other ammoniacal salts, coma and tetanic convulsions. On account of the actions ascribed to it in medicinal doses it is used in the slighter kinds of fever and febrile disorders, and in the advanced stages of acute inflammations after their violence has been subdued by other more active means. It is farther considered an emmenagogue; and it has been given as a diuretic in dropsy.——Externally it is in general use by British surgeons as a stimulating ingredient of discutient lotions, especially for removing the tumours of contusions, or of some stimulant gargles for the chronic form of cynanche tonsillaris. It is also a proper ingredient of lotions for various forms of indolent inflammation, among the rest for chilblains. It was also once employed as an external refrigerant on account of the cold produced by it when in the act of being dissolved; but this application of it has been abandoned in recent times for more certain measures.

Its dose internally is from five to thirty grains. A good discutient lotion consists of twenty-four parts each of rectified spirit and distilled vinegar and one part of hydrochlorate of ammonia. All the other compounds of ammonia used in medicine are prepared more or less directly from this salt.

AMMONIÆ SPIRITUS, *E. L. D.* *Solution of Ammonia, (Edin.),—of carbonate of ammonia (Lon. Dub.) in rectified spirit.*

TESTS, *Edin.* It has a density about 845, and a strong ammoniacal odour: it does not effervesce with diluted muriatic acid.

TESTS, *Lond.* Its density is 860.

PROCESS, *Edin.* Take of
Rectified spirit, two pints;
Fresh-burnt lime, twelve ounces;
Muriate of ammonia in very fine powder, eight ounces;
Water, six fluidounces and a half.
Let the lime be slaked with the water in an iron or earthen vessel, and cover the vessel till the powder be cold: mix the lime and muriate of ammonia quickly and thoroughly in a mortar, and transfer the mixture at once into a glass retort: adapt to the retort a tube which passes nearly to the bottom of a bottle containing the rectified spirit: heat the retort in a sand-bath gradually, so long as any thing passes over, preserving the bottle cool. The bottle should be large enough to contain one-half more than the spirit used.

PROCESS, *Lond.* Take of
Hydrochlorate of ammonia, ten ounces:
Carbonate of potash, sixteen ounces;
Rectified spirit, and
Water, of each three pints.
Mix them, and distil off three pints.

PROCESS, *Dub.* Take of
Rectified spirit, three (old wine) pints.
Carbonate of ammonia in coarse powder, three ounces and a half.
Dissolve with a gentle heat and filter.

SPIRITUS AMMONIAE AROMATICUS, E. L. D.

PROCESS, *Edin.* Take of
Spirit of ammonia, eight fluidounces.
Volatile oil of lemons, one fluidrachm;
Volatile oil of rosemary $1\frac{1}{2}$ fluidrachm;
Dissolve the oils in the spirit by agitation.

PROCESS, *Dub.* Take of
Spirit of ammonia, two (old wine) pints;
Volatile oil of lemons, two drachms;
Nutmeg bruised, half an ounce;
Cinnamon bruised, three drachms.
Macerate for three days in a closed vessel, shaking occasionally, and then distil off a pint and a half (old wine measure.)

PROCESS, *Lond.* Take of
Hydrochlorate of ammonia 5 ounces;
Carbonate of potash, eight ounces;
Cinnamon bruised, and
Cloves bruised, of each two drachms;
Lemon-peel, four ounces;
Rectified spirit, and
Water, of each four pints.
Mix them, and distil off six pints.

TINCTURA AMMONIAE COMPOSITA, L.

PROCESS, *Lond.* Take of
Mastic, two drachms;
Rectified spirit, nine fluidrachms;
Oil of lavender, fourteen minims;
Oil of amber, four minims;
Stronger solution of ammonia, a pint.
Macerate the mastic in the spirit, to dissolve it, pour off the clear tincture, add the other ingredients, and agitate well.

SPIRITUS AMMONIAE FOETIDUS, E. L. D. See *Assafœtida.*

Chemical History.—The term SPIRIT OF AMMONIA is here applied to two very different preparations. The Edinburgh College adopts a solution of ammoniacal gas in rectified spirit; while the two other Colleges substitute a solution, in the same menstruum, of a carbonate of ammonia, in which the acid and base are united in the proportion of one equivalent of each. The former is a powerful ammoniacal preparation, which, among other properties, dissolves energetically resins and volatile oils. In the latter, the physiological actions of ammonia are subdued, and its power of dissolving resins and oils weakened, by combination with carbonic acid.

The formula for the Edinburgh spirit requires no comment. The ammonia is obtained upon precisely the same chemical principles as for the watery solution (see Ammoniæ aqua). The Dublin process seems a mere process of solution; but, in reality, carbonic acid is

disengaged (Barker), and the sesquicarbonate consequently converted in all probability into the true carbonate of ammonia. The London formula is faulty, because wasteful. This was pointed out long ago by my predecessor Dr Duncan; who states, and, according to my own experiments, with justice, that a much larger quantity of carbonate of ammonia is distilled over than is necessary to saturate the spirit. The solution obtained seems, as in the Dublin process, a solution of the true carbonate ($NH^3 + CO^2$), not of the sesquicarbonate. The Edinburgh preparation has a strong, that of the two other Colleges, a much weaker odour of ammonia. The latter effervesces with diluted muriatic acid, owing to the escape of carbonic acid. The former presents no such appearance, unless old and carelessly kept. It absorbs carbonic acid from the atmosphere, but much more slowly than the aqueous solution of ammonia. Both forms are used as pharmaceutic menstruums for dissolving resinous and gummy-resinous substances, as well as those which owe their virtues to volatile oils; and, as already observed, the caustic spirit is for such purposes the more active solvent. The preparations of this kind are the *Spiritus ammoniæ aromaticus*, popularly known as spirit of Sal volatile, *Spiritus ammoniæ fœtidus*, *Tinctura guaiaci ammoniata*, and *Tinctura valerianæ ammoniata*. The caustic spirit is the only form which ought to be used for preparing the *Tinctura opii ammoniata*, E. This preparation has been often unjustly criticised, owing to its having been incorrectly made with the carbonated spirit, which has not, like the caustic spirit, the property of dissolving morphia.

Actions and Uses.—The spirit of ammonia possesses the stimulant and antispasmodic virtues of the aqueous solution of ammonia and the sesquicarbonate of that alkali. It is one of the most convenient of all the ammoniacal preparations for internal use as an antispasmodic; and its energy is increased by uniting it with gum-resins and volatile oils. Its best form for general purposes as a stimulant antispasmodic is the aromatic spirit.

The doses of its preparations are *Spiritus ammoniæ*, E. min. xxx. ad fl. dr. j.—*Spiritus ammoniæ aromaticus*, min. xxx. ad fl. dr. j.—*Spiritus ammoniæ fœtidus*, min. xxx. ad fl. dr. j. *Tinctura ammoniæ composita*, L. min. x. ad xl. They are most conveniently given in a wine glassful of water with a little syrup.

AMOMUM CARDAMOMUM, *D.* See *Cardamomum.*

AMOMUM ZINGIBER, *D.* See *Zingiber.*

AMYGDALA AMARA, *E. L. D.* *Kernel of Amygdalus communis, var α. DC. Bitter-almond.*

AMYGDALA DULCIS, *E. L. D.* *Kernel of Amygdalus communis, var. β. DC (and var γ. DC. Edin.)—Sweet-almond.*

AMYGDALAE OLEUM, *L.* *Expressed oil of either the sweet or bitter-almond.*

MISTURA AMYGDALARUM, L. E. D.

PROCESS, *Lond. Edin.* Take of
Almond confection, two ounces (and a-half, L.)
Water, two pints (distilled one pint, L.)
Add the water gradually to the confection, triturating constantly, and strain through linen.

Or (*Edin.*)
Sweet almonds an ounce and two drs;
Pure sugar, five drachms;
Mucilage, half a fluidounce;
Water, two pints.
Steep the almonds in hot water and peel them. Proceed as for the Mistura acaciæ. See *Gummi Arabicum.*

PROCESS, *Dub.* Take of
Peeled sweet-almonds, an ounce and a-half;
Bitter almonds, two scruples;
Pure sugar, half an ounce;
Water, two (old-wine) pints and a-half.
Rub the almonds with the sugar, adding the water gradually; then strain.

CONFECTIO AMYGDALARUM, L. D. CONSERVA AMYGDALARUM, E.

PROCESS, *Edin. Lond. Dub.* Take of
Sweet almonds, eight ounces;
Powder of gum-arabic, an ounce;
Pure sugar, four ounces.
Blanch the almonds by maceration and peeling; and beat them with the gum and sugar into a uniform pulpy mass. (This confection may be longer kept, if the almonds, gum, and sugar be triturated separately, and only beat together when the confection is to be used, *Lond.*)

FOR. NAMES.—*Amygdalæ dulces.*—*Fren.* Amandes douces.—*Ital.* Mandorle dolci.—*Span.* Almendras dulces.—*Port.* Amendoas doces.—*Ger.* Süsse mandeln.—*Dut.* Zoet amandel.—*Swed.* Soetmandel.—*Dan.* Sode mandler. —*Russ.* Sladkoi mindal.—*Arab.* Louz.—*Pers.* Badamie Farsie.—*Tam.* Parsie vadamcottay.
Amygdalæ amaræ.—*Fren.* Amandes amères.—*Ital.* Mandorle amare.—*Span.* Almendras amargas.—*Port.* Amendoas amargosas.—*Ger.* Bittere mandeln. —*Swed.* Bitter-mandel.—*Russ.* Gorkoi mindal.
FIGURES of Amygdalus communis in Hayne, iv. 39.—Nees von E. 312, 313.— Steph. and Ch. i. 43.

Natural History.—The almond was known to the Israelites. The tree was the Αμυγδαλη of the Greeks, who were well acquainted with both the sweet and bitter almond, the Αμυγδαλα γλυκεια and Α. πικρα of Dioscorides. The tree seems to have a very extensive range, as it grows naturally in Barbary, and in Asia from Syria to Affghanistan. It is cultivated in the whole of the southern and even some of the middle countries of Europe. In Britain it is cultivated only as an ornamental tree; though in some seasons it ripens its fruit, and occasionally even in this neighbourhood. The tree is the *Amygdalus communis* of botanists, a plant belonging to the *Amygdalaceæ* or *Drupaceæ* in the natural classification, and arranged by Linnæus in his class and order *Icosandria Monogynia.* The two kinds of almond, the bitter and sweet, have been recognized by the British Colleges, and are generally considered, as the produce of one species. There are not wanting botanists however who hold them to be the produce of two distinct species. It is certainly extraordinary that the same plant should produce two kinds of fruit so dissimilar in composition and properties. But the anomaly is not greater perhaps, than that a bland kernel, such as the sweet-almond, should be produced by any amygdalaceous plant at all. Besides, the trees which produce the two fruits bear the closest resemblance in botanical characters,—the sole distinctions being, that in the bitter-almond tree the style is of the same length with

the stamina and the petioles spotted with glands,—while in the sweet-almond tree the style is much longer than the stamina, and glands are found not on the petiole but on the base of the leaf or its lower serratures (Nees von Esenbeck). Farther, the author just quoted states he had been informed on good authority, that in the Palatinate bitter-almonds are not unfrequently gathered from the sweet-almond tree.

The fruit of the almond-tree consists of a short close-set down covering a thin leathery pericarp, and a hard rough shell within this, enclosing a brittle emulsive seed. The commercial almond commonly consists of the last part only; but the sweet-almond, which has a thin brittle shell, is sometimes imported with that covering, and is then sold under the name of Shell-almonds. The bitter-almond is always shelled before it comes to this country. The sweet-almond is commonly the larger of the two, but this is not an invariable character. In trade several varieties of the sweet-almond are known, among which the chief are the Valentia and the Jordan almond. The latter is longer, narrower, more pointed than the former, and more esteemed than any other sort. The former is from Valentia, the latter from Malaga. Of the bitter-almond, which is imported from Mogadore, only one variety is acknowledged in trade; and yet this sort differs more in quality than the sweet kind. Both have a thin membranous tegument, brown, rough, and somewhat astringent. Both are without odour, notwithstanding what many say to the contrary; for the bitter-almond has no odour unless its cotyledonous part is brought in contact with water. The sweet variety has a bland, sweet, milky taste; while the bitter has a peculiar, powerful, warm, aromatic bitterness, exceedingly pleasant if not too concentrated. Both varieties when triturated with water furnish a large quantity of opaque, white emulsion. The best almonds of both sorts are large, unbroken, not worm-eaten, recent, of a white fracture, and free of musty odour. When old or worm-eaten their fracture is pale-brownish, and they have an unpleasant musty odour and taste, which are communicated to their oil and their emulsion.

Chemical History.—The composition of the sweet and bitter-almond involves some interesting facts and inquiries in organic chemistry. The nature and properties of the proximate principles contained in them have been examined with great care by Boullay, Vogel, Robiquet and Boutron, Liebig and Wöhler; and the whole subject is now well understood. The sweet-almond consists of about 54 per cent of a bland, fluid, fixed oil, and 24 per cent of a variety of soluble vegetable albumen, termed Emulsin or Synaptase,—together with sugar, gum, moisture, and tegument. Synaptase is the principle by which the oil is suspended in almond emulsion. The bitter-almond contains rather less fixed oil and more synaptase than the sweet-almond, and also from 1.0 to 2.5 per cent of a principle not contained in that variety at all. This principle, which is termed

Amygdalin, and was discovered by Robiquet, is a colourless crystalline, azotized body, of a pure bitter taste, and free of odour. It presents many interesting chemical relations; but the only property requiring mention here is, that when brought in contact with a solution of synaptase, a volatile oil is at once generated, which is composed of a true essential oil (Hydruret of Benzule) and hydrocyanic acid, and which is the source of the peculiar aroma of the bitter-almond when moistened.

It has been long known that the bitter-almond when distilled with water yields a poisonous hydrocyanated essential oil; which was naturally supposed to exist in the almond. But it does not exist ready-formed; for the almond has no odour of it even when heated; neither is any removed with the fixed oil by expression, nor by the solvent action of ether. The volatile oil of bitter-almond is in fact not produced unless water comes in contact with the pulp; but in that case it is promptly generated, as the sense of smell at once proclaims. Its formation depends on the mutual action of amygdalin and synaptase, under the co-operation of water (Liebig and Wöhler.)

The fixed oil of almonds, the Almond Oil of the shops, is prepared by expression, either from the sweet almond, or more commonly from the bitter sort; from which it is obtained quite as bland as from the other, if the contact of water be avoided. It is a pale yellow, very liquid oil, inodorous when fresh, and of a faint, pleasant, oleaginous taste. It may be rendered colourless by heating it gently with an eighth of its weight of good ivory-black. It is one of the most esteemed oils in the cosmetic art. Its density is between 917 and 920. It remains fluid at a much lower temperature than olive-oil; but at 14° it parts with 24 per cent of the concrete fatty matter, margarin; and 76 parts remain of the fluid oil, or elaïn (Braconnot). It is very soluble in ether; and cold alcohol takes up a twenty-fourth of its weight, boiling alcohol a sixth.—The cake left after expression of the oil is sometimes ground, to form the Almond-powder of the shops, an article in common use as a detergent for keeping the skin of the hands soft.

The Essential Oil of bitter-almond is an amber-coloured oil as usually seen; but when prepared from almonds deprived of their skins it is at first colourless. It is obtained by distilling the pulp of bitter-almonds with water, after the separation of their fixed oil by expression. The material is very apt to boil over, but this is prevented by mixing with the water an ounce of sulphuric acid for every five pounds of almonds (Steer.) The average produce of a pound of almonds is one drachm; but the proportion varies much, and has appeared to me greatly less in old than in new almonds. It has a powerful, peculiar odour and taste, to which the name of ratafia is usually given. The peculiar odour of hydrocyanic acid may be also observed; but the odour of this oil, contrary to what

is commonly stated, differs essentially from that of the pure acid, and does not at all depend on its presence. The oil is heavier than water, its density being 1084 (Pereira). It dissolves in small proportion in water, and communicates its peculiar odour and taste. It is very soluble in alcohol and ether. When exposed to the air it absorbs oxygen and slowly yields foliaceous crystals, which are said to be benzoïc acid, but which seem to vary somewhat in their nature in different circumstances. The oil contains from 8.5 [Schrader] to 14.33 [Göppert] per cent hydrocyanic acid, or according to late experiments by Zeller, between 2 and 5.3 per cent. The acid may be partly discovered by the odour, but more satisfactorily by applying the tests for that acid (page 24) to the watery solution of the oil. The acid adheres to the oil with tenacity, but may be removed by repeated distillation from a solution of caustic potash. The oil then ceases to be a narcotic poison, but retains its proper odour in full intensity. An oil of the same nature is obtained from cherry-laurel leaves, peach-blossoms, bird-cherry-bark, the root-bark of the mountain-ash, the kernels of the cherry, peach, apricot, plum, nectarine, bird-cherry, cherry-laurel, and likewise, as I have ascertained, from the seeds of the apple and white-beam tree or *Pyrus Aria*.

Actions.—The almond, like other oleo-albuminous seeds, is nutritive, but indigestible, by reason of its large proportion of fixed oil. When converted into an emulsion with water it is a good demulcent, which may be used in all diseases attended with intestinal irritation, or affecting the genito-urinary mucous membrane; and it is also an excellent and grateful drink for general purposes. Its chief employment in this country is for mitigating the acrimony of the urine in stone, gravel, cystitis and gonorrhœa, and also as a vehicle for other drugs, such as camphor or resinous substances, which are rubbed with almonds, and then with water to make an emulsion. Its most familiar preparation as a drink or vehicle is the *Mistura amygdalarum* or almond emulsion. This is not well made from the *Confectio amygdalarum*, if long kept. Dr Pereira says a better emulsion is made with four drachms of blanched almonds, one drachm of powdered gum, two drachms of white sugar, and six ounces and a half of water, than by any of the College formulas. The fixed oil is used chiefly for outward friction and for making cosmetic soaps; but it has been sometimes given internally for allaying cough, or as a laxative,—for neither of which objects it is well adapted. There seems no reason for the opinion entertained by some French authors that it possesses anodyne and hypnotic virtues. The bitter-almond is in large doses poisonous and has even proved fatal. It was at one time much employed in cookery, confectionery, and the making of liqueurs, for imparting a ratafia flavour; but its volatile oil is now currently substituted. The bitter-almond was once employed in the treatment of ague, and favourable reports have been made of its effects even in recent times. It has been recommended as an anthelmintic in tænia,—in which however, more certain and safer remedies have displaced it. In pharmacy it is

much used abroad for imparting flavour to potions, and the Dublin College has a preparation of the kind, the *Mistura amygdalarum.* It is undoubtedly a useful addition to some mixtures; but on the other hand there are many who dislike its flavour, or who suffer indigestion from using it, and others cannot eat a single bitter-almond without being attacked with nettle-rash. The bitter-almond-oil, though much used by confectioners for flavouring sweet-meats, is nevertheless in large doses a poison of great activity, which produces the same effects with hydrocyanic acid, and owes its energy to that substance. Two drachms have proved fatal in ten minutes. In the form of solution in water or in that of distilled water, it has been more or less employed in most of the diseases in which hydrocyanic acid has been used more recently; and some pharmaceutic chemists have proposed to substitute for medicinal hydrocyanic acid a solution made with a given proportion of essential oil in water, on the supposition that such a preparation is of more uniform strength, and keeps better. Both reasons however are false; for the acid in different specimens of bitter-almond oil varies exceedingly, and I have ascertained that in the course of time the solution of the oil in water loses almost the whole of its acid. The best method of making bitter-almond water is to agitate the essential oil with water, and to filter the mixture after wetting the filtering paper.

AMYGDALUS PERSICA, *D.* *Leaves of Amygdalus Persica, L. W. DC. Spr. Peach-leaves.*

FOR. NAMES.—*Fren.* Pecher.—*Ital.* Pesco.—*Ger.* Pfirsich-baum.—*Arab.* Khowkh. —*Pers.* Sheftalu.

FIGURE of Amygdalus Persica in Hayne, iv. 38.

THE PEACH was the περσικον μηλον or Persian apple of the ancient Greeks, who used it as a medicinal fruit.

Natural and Chemical History.—The plant which produces it is a tree of moderate stature, originally from Persia, now cultivated in numberless parts of the globe, and capable of ripening its fruit even in Scotland. It belongs to the Linnæan class and order *Icosandria Monogynia*, and to the natural family *Rosaceæ* of Decandolle, or *Amygdalaceæ* of Lindley. Its fruit is a drupa, the fleshy part of which abounds in sugar, while the kernel yields by distillation with water a hydrocyanated volatile oil, like the volatile oil of bitter-almonds. The leaves however are the only officinal part of the plant. They have when fresh a bitterish, astringent, ratafia taste, the last of which peculiarities is most remarkable when they are young; and by distillation with water they yield a poisonous hydrocyanated oil analogous to that from the kernels.

Actions and Uses.—The leaves probably differ but little in their effects on the body from those of the cherry-laurel or *Cerasus Laurocerasus.* They have been used in infusion as a vermifuge. In the dry state, when they become incapable of yielding volatile oil by

distillation with water, they form a mildly astringent infusion which some have employed as a soothing remedy in diseases of the bladder; and they are likewise held to be gently purgative. The fresh flowers and leaves, as well as the kernel of the peach, must be used with some caution, in consequence of the hydrocyanic acid they contain. The plant may be expunged without loss from the Pharmacopœias, as it is put to very little use in British medical practice.

The dose of the dried leaves is about a scruple in infusion several times a-day.

AMYLUM, *E. L. D. Fecula of the seeds of Triticum vulgare, Villars, Delph.—Willd. Hort. Berol.—Spr.* (*Edin.*) *Fecula of the seeds of Triticum hybernum, L.* (*Lond. Dub.*) *Starch.*

MUCILAGO AMYLI, E. D. DECOCTUM AMYLI, L.

PROCESS, *Ed. Lond. Dub.* Take of Starch, half an ounce (six drachms, D.); Water, one (old-wine, D.) pint. Triturate the starch with a little of the water; add gradually the rest of the water; and boil for a few minutes.

FOR. NAMES.—*Fren.* Amidon.—*Ital.* Amido.—*Span.* Almidon.—*Port.* Amido.—*Ger.* Stärkmehl.—*Dut.* Stijfsel.—*Swed.* Stärkelse.—*Dan.* Kraftmeel.—*Russ.* Krachmal.—*Arab.* Abgoon.—*Pers.* Neshasté.—*Hind.* Gehoonkaheer.

FIGURE of Triticum vulgare in Nees Von E. 31.

STARCH OR FECULA is contained in various organs of very many plants. It exists largely in many roots, and is extracted from some of them for medicinal and dietetic use, as in the forms of arrow-root, tapioca, tous-les-mois, and potato-starch. It is also contained abundantly in some stems, especially those of the palm tribe; and when obtained from that quarter, it constitutes another medicinal variety, named sago. But nowhere does it abound so much as in the different kinds of grain, or seeds of the *Cerealia;* of which indeed it forms between sixty and seventy-five per cent. Wheat yields one of its purest varieties. The proportion contained in this grain amounts on an average to seventy per cent. But part is lost in the process of purification; so that eventually more is seldom produced than fifty per cent. Every sort of wheat yields fine starch. The botanical reference indeed adopted by the London College of Physicians would limit the starch-maker to the wheat obtained from *Triticum hybernum,* the autumn-sown variety. But spring-wheat, the *T. æstivum* of botanists, answers equally well; and as both are admitted to be mere varieties of a single species, the *T. vulgare* of Villars and of Willdenow, this species has been adopted by the Edinburgh College as the source of officinal starch. A fine variety is also produced by Spelt-wheat, the seed of *T. Spelta.*

Starch may be easily obtained from wheat-flour by kneading it in a cloth with successive portions of cold water. Wheat-flour consists of starch, gluten, mucilage, albumen, several salts, and some bran. The gluten and bran remain in the cloth: the mucilage, albumen, and salts dissolve in the water: and the starch passing with the water in a state of suspension, gradually falls to the bot-

tom. In this way however it cannot be separated from a little finely-divided gluten, which slightly colours it. On the large scale it is detached from flour by a stream of water without the process of kneading; and its purification from gluten is accomplished chiefly by allowing the albumino-mucilaginous water, from which it has subsided, to undergo fermentation; for the acetic acid thus formed dissolves the gluten.

Starch is usually sold in the form of small, irregular prisms; into which shape it cracks in drying. It is of the purest white colour, without odour, and almost tasteless. Its density is 1.53. It consists of microscopic, transparent particles, which are globular, oval, or angular, and less than those of other kinds of fecula. It is permanent in dry air. In moist air it slowly absorbs twenty-four per cent of water without losing its dry appearance. In its ordinary state it contains about twelve per cent of moisture, which it parts with when gently heated. A strong heat decomposes and chars it; and it burns, though slowly,—leaving a mere trace of earthy and saline residuum. A temperature a little above 212° alters somewhat its nature, inasmuch as, from being soluble in cold water, it becomes in some degree soluble. If not thus previously roasted, it is not dissolved by cold water when gently mixed, even though kept for months in this condition. But either a partial solution, or more probably a state of suspension, so intimate as to resist filtration, is brought about by triturating or even merely agitating the starch with cold water. At a temperature near the boiling point a more perfect, though still not complete, solution takes place, and a mucilage is formed; which, if moderately strong, becomes a loose jelly on cooling. When thus prepared with proportions varying from a fifth to a twentieth of the water, it forms starch-mucilage or paste, as used for starching linens; and in the proportion of a fortieth ($\frac{1}{27}$ Dub.) it forms the *Mucilago* or *Decoctum Amyli* of the Pharmacopœias,—a convenient vehicle for suspending many drugs which are administered in the state of powder. Starch is insoluble in alcohol; which however removes from it a trace of essential oil, the source of its peculiar faint odour and taste. It is equally insoluble in sulphuric ether, and in the oils, fixed as well as volatile. Diluted sulphuric acid resolves it into sugar; nitric acid into malic and oxalic acids. Iodine scarcely acts on it when simply moistened with water. But if the starch be previously triturated or agitated with water, action ensues, and a dark purple compound is formed; and a solution of starch, made with hot water, but subsequently cooled, yields immediately with iodine a fine deep blue precipitate of iodide of starch. Iodine thus constitutes the most characteristic of all tests for detecting the presence of this substance. The starch contained in the grains is converted into sugar and gum by the process of germination, whether arising naturally, or induced artificially, as in malting barley. This singular chemical change is brought about by means of a peculiar principle developed

in the seeds, named Diastase (see *Hordeum*), whose action on starch will be explained presently.——According to Dr Prout, starch is composed of 44 parts by weight of carbon, 6.22 hydrogen, and 49.78 oxygen, and consequently of 12, 10 and 10 equivalents of these elementary bodies (C^{12} H^{10} O^{10}). Several of its chemical relations already noticed, as well as some which remain to be mentioned, will be better understood on taking into account its peculiar constitution and the properties of the proximate principles of which it is composed.

Starch was long considered a simple proximate principle. But according to the late discoveries of Raspail, extended by the ulterior inquiries of various experimentalists, more especially of MM. Payen and Persoz, its globules consist of two proximate principles, an external tegument, termed Amylin, and a contained mucilage, named Amidin. These discoveries have thrown some light on the chemical properties of starch, and have led to a considerable extension of its economical uses.

The starch-globules may be resolved into their constituent principles in two ways. The first is by the action of hot water. When placed in boiling water, their membranous teguments burst and float through the water, while the contained mucilage is dissolved. The dissolved and insoluble matters are amidin and amylin, which may be separated in a state of purity, but not so easily as when the starch-globules are resolved by the second method. This is by the action of the proximate principle, diastase. If starch be mixed with four parts of water and a thousandth of its weight of diastase, and the mixture be maintained steadily at a temperature between 150° and 175° F. the globules in a few minutes burst, a solution is obtained nearly as fluid as water, and the tegumentary membranes of the globules gradually subside. The change effected thus far is essentially the same with that which takes place in boiling water; but the separation of the principles is more perfect, because in the latter case some amidin adheres obstinately to the tegumentary amylin.

Pure amidin and amylin may be obtained after the action of diastase in the following manner. Amylin is easily procured by allowing the mixture to remain for a few hours at the temperature specified above, till the liquor no longer becomes blue with iodine when cooled. The saccharo-mucilaginous solution, into which the amidin is thus entirely converted, is then removed after rest and subsidence. The precipitated teguments are next to be thrown on a filter, washed thoroughly with water to remove any adhering gum and sugar; and finally the spongy mass which remains is dried over the vapour-bath. This is amylin.——In order to obtain pure amidin the liquid mixture produced by the action of diastase, as soon as complete liquidity is accomplished, must be suddenly raised to the temperature of 200° or 212°, in order to prevent the farther changes which the presence of diastase would otherwise effect.

The liquor must then be cooled and left at rest till the teguments subside. The clear supernatant fluid is next to be concentrated by means of a heat between 212° and 230° to the consistence of syrup, and skimmed from time to time, as the teguments which had not subsided rise to the surface. From this syrupy fluid dry amidin may be obtained pure enough for economical purposes by simple evaporation in thin layers. But for attaining chemical purity, it is advisable to throw down the amidin by means of rectified spirit, and to wash it on a filter with that liquid; after which it is to be redissolved in boiling water, and evaporated to dryness over the vapour-bath.

Amidin, or amidone, as it is sometimes called, is colourless when quite dry, tasteless, transparent, elastic, and brittle. It presents essentially the chemical relations of starch, of which it constitutes 995 or 996 thousandths. In moist air at 60° F. it absorbs 24 per cent of water, but continues dry. In cold water it swells and assumes the appearance of a jelly, but without dissolving. By trituration, however, or agitation, it becomes so intimately suspended, if not actually dissolved, in the water, as to form a transparent fluid which passes unchanged through a filter. At 150° it dissolves in water, and the solution forms a jelly on cooling. If afterwards dried, it is recovered with its original properties. It is insoluble in alcohol, ether, or oils. The cold emulsion in water, and the hot solution, after being cooled, are equally rendered blue by iodine. The colour disappears at 194° F. and reappears on cooling if the solution be not too diluted, but it is permanently destroyed by ebullition, and also by chlorine added in excess. The emulsion and solution are precipitated by alcohol, the amidin being detached unaltered. They are also precipitated by infusion of galls, by lime, baryta, and diacetate of lead; and in the case of the last three substances compounds are formed of amidin with the metallic oxides. They are not precipitated by sulphate of iron, sulphate of copper, chloride of barium, or bichloride of mercury. Amidin, like starch, yields malic and oxalic acids when digested with nitric acid; and with diluted sulphuric acid a variety of sugar is formed, which corresponds in properties with grape-sugar. One hundred parts of amidin yield rather more than 110 grains of sugar. Its most remarkable property however is its relation to diastase. When amidin is mixed with a two-thousandth of its weight of diastase, and is maintained for a few hours between the temperatures of 150° and 175°, its watery solution is entirely converted into sugar and gum, without any escape of gas or other obvious phenomena, and without any change of weight in the articles employed. This action is prevented by a diminution of temperature under 150° or an increase of it above 175°. It is also prevented by the presence of tannin. But the alkaline and earthy carbonates, various neutral salts, and even a slight excess of various acids, have not any preventive power. The action is the same with that which takes place

naturally during the germination of seeds. The sugar produced is uncrystallizable, soluble in alcohol, and capable of fermenting with yeast, so as to form alcohol; and amidine cannot undergo the vinous fermentation with yeast before being converted by diastase into sugar. The gum is soluble in water, insoluble in alcohol, and capable of being converted into sugar by being boiled in four times its weight of water acidulated with a hundredth of sulphuric acid. ——The elementary composition of amidin seems identical with that of starch; for according to Payen, it is composed of 12 equivalents of carbon, 10 of hydrogen, and 10 of oxygen.——The Dextrin of M. Biot is amidin rendered impure with variable proportions of starch-sugar and starch-gum.

Amylin, as the tegumentary principle has been appropriately named by Dr Thomson, constitutes only four or five parts in one thousand of starch. In the starch-globules it contains a trace of volatile oil and some amidin intimately united with its molecules. But when pure, it is colourless, translucent, and tasteless. It swells up in water, but cannot be dissolved even with the aid of prolonged ebullition. It is insoluble in alcohol. Iodine has no action on it. Diastase is equally inert. Sulphuric and nitric acids act on it as upon amidin. Its elementary composition appears identical with that of amidin, though slight differences have been obtained by some experimentalists. It bears a strong resemblance to lignin, or the woody principle, in its chief properties.

Adulterations.—Starch is subject to various adulterations, among which the most important are sulphate of lime or other fixed earthy salts, and superabundant moisture. The former is discovered by incinerating the suspected article; the latter by drying it in the vapour-bath, by which not more than twelve per cent of loss ought to be sustained.

Actions and Uses.—In relation to the animal body starch is a nutrient and demulcent. It is the most abundant, most important, and probably the most digestible of all nutritive principles from the vegetable world; and it is therefore extensively used in its various simple forms of arrow-root, tapioca and sago, as well as in its compound states of wheat-flour, oat-meal, barley, rice, and the like, in the dietetic treatment of almost all diseases. As a more purely medicinal agent, it is used in the form of mucilage on account of its demulcent properties in dysentery, more especially in the way of injection,—and also in the form of lozenge along with gum as a demulcent in catarrh and sore-throat. Its most important medicinal application, however, is in the form of mucilage, for suspending such drugs as are given in the state of powder, or in the shape of emulsion, and likewise for administering in the way of injection all active substances which are intended to be retained for some time in the great gut. Sometimes it is employed in the dry state as an excipient for making pills, and also for covering them. Lastly, starch in the form of hair-powder has long been held a sovereign

remedy for intertrigo in children, and a useful local application for soothing the pain of erysipelas. It is better for preventing than for curing intertrigo; and, as for its use in erysipelas, though sanctioned by immemorial usage, it has appeared to me much inferior to anodyne lotions of acetate of lead and opium.

Its preparations are *Mucilago amyli*, E. D. *Decoctum amyli*, L. *Trochisci acaciæ*, E. *Pulvis tragacanthæ compositus*, L.

AMYRIS ELEMIFERA, *D.* See *Elemi.*

ANETHUM, *E. L.* *Fruit of Anethum graveolens* (*L. W. DC.*) *Dill.*

AQUA ANETHI, E. L.

PROCESS, *Edin. Lond.* Take of Anethum-seeds, bruised, 18 ounces; Rectified spirit, three fluidounces; Water, two gallons. Mix them together, and distil off one gallon.

OLEUM ANETHI, E.

PROCESS, *Edin.* To be prepared according to the general directions for the preparation of Volatile oils. See *Introduction.*

FOR. NAMES.—*Fren.* Aneth.—*Ital.* Aneto.—*Span.* Eneldo.—*Ger.* Dill.—*Swed.* Dill.

FIGURES of Anethum graveolens in Hayne, vii. 17.—Steph. and Ch. iii. 137.

DILL, the Ανηθον of Dioscorides, is a native of the middle and southern countries of Europe, and is cultivated in Britain for medicinal purposes. It is an annual umbelliferous plant, belonging to Linnæus' class and order *Pentandria Digynia.* It is retained in the Pharmacopœias because often prescribed; but it has no properties to distinguish it from other umbelliferous aromatics, more especially from caraway, which it resembles in flavour. The officinal part is the fruit, which is prescribed in the form of infusion, or more generally in that of distilled water, the officinal *Aqua anethi.* It has a bitter, pungent, aromatic taste. The water possesses aroma without bitterness. It owes its properties chiefly to a volatile oil, which may be obtained by distillation with water, as the Edinburgh College directs, to the amount of about three per cent. This oil closely resembles caraway-oil in taste and odour.

The seed, its essential oil, and its distilled water possess the stimulant, antispasmodic and carminative properties of the umbelliferous aromatics generally. It is chiefly employed as a carminative. The dose of the distilled water, or *Aqua anethi*, is from one to four fluidounces,—that of the oil, five minims.

ANGELICA, *E.* *Root of Angelica archangelica* (*L. W. Spr.*) *Angelica.*

ANGELICAE ARCHANGELICAE SEMINA, *D.* *Fruit of Angelica archangelica.*

FOR. NAMES.—*Fren.* Angélique.—*Ital. Span. and Port.* Angelica.—*Ger. the root,* Engelwurzel:—*Swed.* Angelikcrot.—*Dan.* Angelik ; Ovanne.—*Russ.* Diavil.
FIGURES of Angelica archangelica in Hayne, vii. 8. Nees von E. 279, 280. Roque, 108. Steph. and Ch. ii. 83.

ANGELICA is a very old article of the Materia Medica. The plant grows naturally in the middle and northern parts of Europe, and is cultivated in Britain. It is the *Angelica archangelica* of some botanists, the *Archangelica officinalis* of Koch, Decandolle, and Lindley. It belongs to the *Umbelliferæ* in most natural arrangements, and to the *Pentandria Digynia* in Linnæus' classification. The part in general use is the root; but the Dublin College substitutes the seeds. The whole plant has a strong, peculiar, rather fragrant odour. The root consists of numerous simple radicles proceeding from a spindle-shaped root-stock, about an inch and a-half in diameter at top, and a foot long, dark-brown externally, white within, tough, of an agreeable odour, and of a warm, bitterish, sometimes sweetish taste. As the plant is biennial, the root presents its sensible properties in greatest perfection in the spring; but that which is dug up in autumn is said to be less apt to spoil. It should be dried quickly and thoroughly. It is then grayish-brown, tough, soft, prone to be attacked by insects, and to absorb moisture, which causes it to decay. It should therefore be kept in a dry place. The best way to preserve it is to pulverise it, and to pack the powder firmly in bottles or close boxes. It owes its properties to a volatile oil and a bitter extractive matter. Bucholz and Brandes found in it, besides lignin and water, 20 per cent of bitter extract, 6 of a warm, bitterish resin, 36 of gum, a little starch and albumen, and 7 parts per thousand of volatile oil; and more recently Buchner junior has obtained from it a peculiar volatile acid, angelic acid, and a crystalline subresin, angelicin. The root of the shops is often spoiled by insects or decay. That of the *A. sylvestris* is often substituted for it. This is distinguished by being much smaller, less white when fresh, less furnished with radicles, more delicately fibrous, and of a weaker odour.—The seeds have the odour of the root. The leaf-stalks, as they possess a rather pleasant sweetish mucilaginous and aromatic taste, are used for making a familiar confection, called Candied-angelica.

Angelica-root is a diffusible stimulant and carminative, like other umbelliferous aromatics. It is thought by many to be one of the best of the aromatics of temperate countries. The seeds form part of the materials from which the compound-anise-spirit of the Dublin College is prepared. A distilled water might be a useful addition to the Pharmacopœias, because it has a pleasant taste and odour, and water holds in solution an unusual proportion of the essential oil of this plant (John).

ANGUSTURA, *D.* See *Cusparia.*

ANISUM, *E. L.* PIMPINELLA ANISUM, *D.* *Fruit of Pimpinella Anisum* (*L. W. DC.*) *Anise.*

OLEUM ANISI, E. L. D.

PROCESS. *Edin. Lond. Dub.* To be prepared according to the general directions for distilling volatile oils. See *Introduction.*

SPIRITUS ANISI, L.

PROCESS. *Lond.* Take of
Anise bruised, ten ounces;
Proof-spirit, a gallon;
Water, two pints.
Mix them, and distil a gallon with a gentle heat.

SPIRITUS ANISI COMPOSITUS, D.

PROCESS. *Dub.* Take of
Anise bruised, and
Angelica-seeds bruised, of each half a pound.
Proof-spirit, a gallon;
Water, enough to prevent empyreuma.
Macerate for twenty-four hours and distil off one gallon.

FOR. NAMES.—*Fren.* Anis.—*Ital.* Anace; Anice.—*Span.* Anis—*Port.* Herva doce.—*Ger.* and *Swed.* Anis.—*Dut.* Anys.—*Dan.* Annis.—*Russ.* Anis; Ganus. —*Arab.* Anison.—*Pers.* Razyaneh roomie.—*Tam.* Somboo.

FIGURES of *Pimpinella Anisum* in Hayne, vii. 22. Nees von E. 275. Steph. and Ch. iii. 156.

ANISE was one of the aromatics of the ancient Materia Medica, being the Ανισον of Dioscorides.

Natural and Chemical History.—The plant grows wild in Egypt and the Levant, and is extensively cultivated in various countries of continental Europe. It is the *Pimpinella Anisum* of most botanists, and *Sison Anisum* of Sprengel. It belongs to the natural family *Umbelliferæ*, and Linnæus' class and order *Pentandria Digynia.* The officinal part is the fruit. This is imported into England from Spain and Germany. The Spanish variety, commonly called Alicant aniseed in commerce, is smaller and paler grayish-yellow than the rest, and is the most esteemed. The inferior German seed is darker grayish-brown. It is of an ovate form, about the size of a grain of oats, but shorter, and composed of two fruits of a concavo-convex form connected at their concave surfaces. Each fruit consists of a loose outer ligneous membrane, which is tasteless and inert,—of an internal, delicate, firmly adhering membrane, in which the anise odour entirely, and the taste in a great measure, reside,—and of the parenchyma of the seed, or seed proper, which is somewhat oily, but without aroma. Aniseed has a strong aromatic taste and a powerful, penetrating odour, more agreeable than that of most umbelliferous seeds. The taste and odour, though remarkable, are not peculiar, being equally possessed by the *Myrrhis odorata,* an indigenous umbelliferous plant, the *Fœniculum Panmorium,* an umbelliferous inhabitant of the East Indies, and by the capsules of the fruit of *Illicium anisatum,* the Star-anise of liqueur-makers. It yields by expression a little fixed oil aromatised with volatile oil, and by distillation with water about three per cent of volatile oil, the common Oil of anise of the shops. The other ingredients are 3.5 per cent of fixed oil, 14.5 of gummy principles, a little sugar and resin, with a variety of salts, among which the malate of lime

is the most abundant. The volatile oil passes readily over in distillation with water or spirit. It is colourless, has a powerful odour of aniseed, and at ordinary winter temperatures in this climate assumes the form of a concrete crystalline mass. The reason of its solidification in winter is that it contains an unusually large proportion of the Stearoptin or solid principle of the volatile oils; so that at 50° this crystallizes in the fluid principle or Elæoptin. Both principles agree exactly in their sensible properties; and they appear to have the same ultimate composition, being composed of 10 equivalents of carbon, 6 of hydrogen, and 1 of oxygen (Blanchet and Sell). The Stearoptin becomes liquid when long kept.

Anise is one of the most agreeable of the umbelliferous aromatics; yet many dislike its flavour. It is extensively used abroad for flavouring confections and liqueurs. Its chief application in British practice is as a carminative; for which purpose an infusion of two table spoonfuls is sometimes administered as an injection, or the simple or compound spirit by the mouth.

The doses of its preparations are: *Anisum*, E. L. *Anisi semina*, D. gr. x. ad dr. ss.—*Oleum anisi*, E. L. D. min. v. ad min. x.—*Spiritus anisi*, L. min. xx. ad fl. dr. ii.—*Spiritus anisi compositus*, D. min. xxx. ad fl. dr. ii.

ANTHEMIS, *E. L.* FLORES CHAMAEMELI, *D.* *The* (*simple,* L. E.) *flowers of Anthemis nobilis, L. W. DC. Spr.*—*Chamomile.*

DECOCTUM CHAMAEMELI COMPOSITUM, D.

PROCESS, *Dub.* Take of
Chamomile-flowers dried, half an ounce;
Sweet-fennel seeds, two drachms;
Water, a pint:
Boil for a little, and strain.

EXTRACTUM ANTHEMIDIS, E. CHAMAEMELI, D.

PROCESS, *Edin.* Take of chamomile a pound. Boil it with a gallon of water to four pints; filter hot; evaporate in the vapour-bath to the right consistence.

PROCESS, *Dub.* To be prepared from chamomile-flowers according to the general directions for extracts. See *Introduction.*

INFUSUM ANTHEMIDIS, E. L. CHAMAEMELI, D.

PROCESS, *Edin. Lond. Dub.* Take of
Chamomile, 5 drachms;
Boiling-water (distilled, L.) one pint.
Infuse for ten minutes (twenty-four hours, D.); and then strain.

OLEUM ANTHEMIDIS, E. L.

PROCESS, *Edin. Lond.* To be prepared according to the general directions for volatile oils. See *Introduction.*

FOR. NAMES.—*Fr.* Camomille Romaine.—*Ger.* Römische Chamille.—*Ital.* Camomilla Romana—*Span.* Manzanilla Romana.—*Port.* Marcella Romana.—*Dut.* Roomsche Kamille.—*Swed.* Romerska Kamillblommor—*Dan.* Romerske cameelblomster.—*Russ.* Romashka rimskaia.—*Arab.* Edaklmirzic,—*Pers.* Babvoneh gaw.—*Tam.* Chamaindoo poo.

FIGURES of Anthemis nobilis in Steph. and Ch i. 38, Nees von E. 245.—Hayne, x. 47.—Eng. Bot. 980.

CHAMOMILE-FLOWERS have long been an article of the Materia Medica of Europe, and are considered by some to have been the Παρθένιον of the Greek physicians. They are often called Roman

chamomile, to distinguish them from common chamomile, the flowers of *Matricaria Chamomilla.*

Natural History.—They are produced by the *Anthemis nobilis*, a perennial plant belonging to Linnæus' class and order *Syngenesia Polygamia-superflua,* to the division *Corymbiferæ* of the family *Compositæ* in Decandolle's arrangement, and to the *Asteraceæ* in the classification of Professor Lindley. The plant is a native of Southern Europe and the south of England; and it is also extensively cultivated for medical use. The flower is the only officinal part. Like the flowers of the other *Compositæ,* that of chamomile consists of numerous florets circularly arranged on a common receptacle. Two varieties are met with in the shops, the single and double, which are sometimes distinguished by the epithets of Scotch and English chamomile. The former is most esteemed; and the London and Edinburgh Colleges, not without reason, acknowledge no other. It is apt to be confounded with the flower of *Matricaria Chamomilla,* the common chamomile, and that of *Pyrethrum Parthenium,* the feverfew; but it is easily distinguished by the receptacle being covered with scales between the florets, while in these two species it is naked.

Chamomile flowers have an aromatic, very bitter taste, and a strong peculiar odour. They contain bitter extractive matter and volatile oil. The oil, which may be obtained by distillation with water to the amount of eight parts from a thousand, is at first greenish or bluish, but afterwards yellowish-brown. It concentrates in itself the odour of the plant. The flowers part with their bitterness and aroma both to water and alcohol. The former menstruum exhausts them completely when used in the way of infusion; so that the *Decoctum anthemidis* of the Dublin College is a needless preparation. The *Extractum anthemidis* of the Pharmacopœias contains the bitter principle without the oil, which is dispersed by the evaporation. The solution of this extract, as well as the infusion of the flowers, contains a little tannin, and is therefore rendered grayish-black by the sesquioxide-salts of iron. Chamomile seeds contain a fixed oil, which is sometimes obtained by expression for economical purposes.

Chamomile flowers are stimulant and tonic in their action on the healthy body; and in relation to various states of disease they are febrifuge, antispasmodic and carminative. In ancient times, the powder was much used in agues, and in modern times even Cullen speaks favourably of its effects. The infusion, and still more the essential oil, are employed as antispasmodics in colic and cramp in the stomach. But the most frequent application of this drug at present is as a bitter tonic in dyspepsia. It answers very well as such in cases of mere weakness of digestion in the simple form of infusion or extract; and even in cases of irritability of the stomach it may prove serviceable by reason of its antispasmodic and calmative action. An excellent antacid stomachic in ordinary cases of

dyspepsia attended with acidity consists of two fluidounces of a fresh infusion, and ten or twenty grains of bicarbonate of soda, taken half an hour before each meal. The simple infusion, under the familiar name of chamomile tea, is the most esteemed of domestic remedies for stomach-complaints. It is equally efficacious and more agreeable to many persons when prepared with cold water. It is worthy of remark, that a strong infusion taken in doses of a tea-cupful generally acts as an emetic; and till a recent date, this was often administered to aid the action of other remedies of the same kind or even singly for its own emetic virtues. The best carminative preparation is the essential oil dropped on a bit of sugar, or in the liquid form with syrup. It is said to be sometimes serviceable in the way of friction over the abdomen; but internally it is one of the most effectual of carminative oils in cases of dyspeptic flatulence and flatulent colic.

The doses of the preparations of chamomile are *Anthemis*, E. L. *Flores chamæmeli*, D. dr. ss. ad dr. ii.—*Infusum anthemidis*, E. L. *Infusum chamæmeli*, D. fl. unc. i. ad unc. iii. as a tonic,—fl. unc. v. ad unc. xii. as an emetic.—*Decoctum chamæmeli*, D. as of the infusion.—*Extractum anthemidis*, E.—*Extractum chamæmeli*, D. gr. x. ad gr. xxx.—*Oleum anthemidis*, E. L. min. v. ad min. xv.

ANTHEMIS PYRETHRUM, *D.* See *Pyrethrum.*

ANTIMONII OXIDUM, *E.* *Sesquioxide of antimony.*

Tests, *Edin.* Entirely soluble in muriatic acid, and in a boiling mixture of bitartrate of potash and water; fusible at a red heat; snow-white.

Process, *Edin.* Take of
Sulphuret of antimony in fine powder, four ounces;
Muriatic acid (commercial), a pint;
Water, five pints;
Dissolve the sulphuret in the acid with the aid of a gentle heat; boil for half an hour; filter; pour the liquid into the water; collect the precipitate on a cloth-filter; wash it well with cold water, then with a weak solution of carbonate of soda, and again with cold water till the washings cease to affect reddened litmus-paper. Dry the powder over the vapour-bath.

ANTIMONII OXIDUM NITROMURIATICUM, *D.* *Sesquioxide of antimony, with some adhering chloride of antimony.*

Process, *Dub.* Take of
Prepared sulphuret of antimony, twenty parts;
Muriatic acid, one hundred parts;
Nitric acid, one part;
Mix the acids, add gradually the sulphuret, digest with a gradually-increasing heat, &c. as above, but without washing the precipitate with solution of carbonate of soda.

For. Names.—*Fren.* Oxide antimonique.—*Ital.* Ossido bianco d'antimonio.—*Ger.* Antimon oxydul.

The pure Sesquioxide of Antimony was first obtained in 1802 by Proust. It has been introduced into the Pharmacopœias of Ireland and Scotland partly on its own account as a good antimonial, but chiefly because it must be made in the process for preparing tartar-emetic.

Chemical History.—It may be obtained in a variety of ways. But the method commonly preferred, because the cheapest and

easiest, is that adopted by the Edinburgh and Dublin Colleges, which consists essentially in dissolving the native sesqui-sulphuret of antimony in muriatic acid to form the sesquichloride of antimony, and then decomposing that compound by the agency of water. In the first stage of the process sulphuretted-hydrogen is disengaged, and a chloride of the metal, or according to an older theory a hydrochlorate of the oxide, remains in the fluid. The small addition of nitric acid in the Dublin formula is thought to be of use by decomposing the sulphuretted-hydrogen which may remain in the fluid at the end; but it has appeared to me unnecessary. The proportion must be small, otherwise a higher oxide is formed, called antimonious acid. The solution is always yellow, owing to the presence of a little iron in the antimonial sulphuret; but this does not interfere with the purity of the oxide ultimately obtained, at least so as to affect it as a medicinal or pharmaceutic agent. The quantity of muriatic acid used in the process appears large, being at least three times as great as is required to furnish the due proportion of chlorine for forming the sesquichloride. It is nevertheless necessary; Dr Clark of Aberdeen informs me he has in vain attempted to reduce the quantity.

The sesquichloride of antimony was once officinal, chiefly as a corrosive, under the trite name of Butter of antimony; but it is never used now in this country, except for preparing the oxide. Its decomposition is accomplished in the second stage of the College processes by subjecting it to the superior affinity of water for its acid; in consequence of which an insoluble sub-salt is in the first place thrown down (Dichloride of antimony; submuriate; powder of algaroth); and this is ultimately obtained more and more free of chlorine or muriatic acid by repeating the affusion of water. The oxide is thus obtained pure enough for its being subsequently used to prepare tartar-emetic; but even frequent washing still leaves a little chlorine, which can only be removed by assisting the affinity of the water with that of an alkali such as soda. The alkali may be used in the shape of carbonate, because oxide of antimony does not unite with carbonic acid. The process is productive according to the quality of the sulphuret used. Dr Barker got 16½ grains of the Dublin oxide from 20 grains of sulphuret; but I have got so much as 1534 from 1750.

Both the pure oxide and that which contains a little chlorine are white powders, tending towards a crystalline appearance, especially if left long in contact with the acid water in which they were first thrown down from the chloride. That which is not quite free of chlorine has a nauseous metallic taste; and when strongly heated, a little sesquichloride of antimony is sublimed from it. In other respects it agrees with the pure oxide. The oxide is tasteless, white, heavy, permanent in the air, insoluble in water, easily soluble in muriatic, tartaric, or acetic acid, and also in a boiling solution of bitartrate of potash. Heat first renders it yellow, which colour

to the Edinburgh formula for extract of monkshood (see *Aconitum*) would be at least equal even to that made by evaporation in vacuo. There seems reason to think too, that spontaneous evaporation of the juice, without water being added to the leaves before expression, will furnish an excellent extract. For internal use a good preparation would undoubtedly be a tincture of the fresh leaves made like the Edinburgh tincture of hemlock.

Actions and Uses.—Belladonna is a powerful narcotic, and in virtue of this action it is in large doses an energetic poison. In medicinal doses it is an anodyne, antispasmodic and calmative, besides being possessed of certain specific properties to be noticed presently. It is one of our most energetic indigenous poisons. Every part of the plant is deleterious; but physicians are best acquainted with the effects of the berries, which are often devoured by children and other ignorant people, who are misled by their appearance to disregard their mawkish taste. The effects are dryness in the throat, difficulty in swallowing, sometimes efforts to vomit;—afterwards delirium, which is generally extravagant and mirthful, or partakes of the nature of somnambulism, and is attended with excessive dilatation of the pupils, and obscurity, perversion, or total suspension of the functions of external sense;—and next coma, which may prove fatal, but which, if it be dispelled, is often succeeded by another stage of wild delirium, and long continuance of dilatation of the pupil. The discharge of black skins by an emetic commonly supplies certain information as to the cause of the symptoms. The proper remedies are emetics and purgatives, cold to the head, and in the comatose stage ammonia internally, with the usual external stimulants. Sometimes colic and diarrhœa are observed after the narcotic symptoms pass away; but they are rare, and when present not often considerable.—Atropia possesses in an eminent degree the poisonous action of the plant. A twentieth of a grain will kill a mouse in twelve hours; and a tenth of a grain will cause in man dryness in the throat, a sense of constriction in the pharynx, difficulty in swallowing, dilatation of the pupil, some stupor and headache (Geiger and Hesse). It is however much inferior in power to aconitina, for whilst a tenth of a grain of the latter killed a rabbit in ten minutes, half a grain of pure atropia did not occasion death at all.

The effects of medicinal doses of belladonna are not yet well ascertained. Its poisonous action seems to indicate important medicinal properties; and it has been applied to the treatment of various diseases both internally as an anodyne and antispasmodic, and externally as an anodyne and for dilating the pupil. We are best acquainted with its external uses. A little of the extract rubbed with the wet finger round the eyelids, or a solution dropped into the eye, causes in an hour or two an extraordinary dilatation of the pupil, so that the iris seems at times almost to disappear. The effect is greatest in the course of three or four hours, and

continues between eighteen hours and three days. It is unattended with any obscurity of vision. But when dilatation is brought on by the internal use of the drug, vision is at the same time much impaired. The singular property of dilating the pupil has led to belladonna being extensively used in ophthalmic surgery,—such as for preventing or breaking down adhesions between the iris and lens in iritis, for inspecting the extent of a cataract, or facilitating the operation of extraction and the like. Belladonna in the form of a liniment of the extract, or in that of the officinal *Emplastrum belladonnæ*, is used as an anodyne in external neuralgia, as of the face, chest or joints, and sometimes with apparent advantage; but it is not to be relied upon. It has also been thought useful in labour protracted by spasm of the os uteri, when directly applied in the form of soft extract (Chaussier),—in constriction of the urethra and severe chordee (Holbrook),—for incontinence of urine in children (Morand),—and in painful spasm of the sphincter of the anus where not connected with a fissure (Blackett). Internally, the extract has been often employed, though little of late in this country, as a general anodyne in muscular rheumatism (Osborne), and in neuralgic affections and states of nervous irritability, instead of opium; in which respect information on its action is much wanted. As an antispasmodic it has been thought useful in the various forms of spasmodic cough, and more especially in hooping-cough, when the febrile stage is nearly over (Hufeland), between the fifteenth and twentieth days.

It has been lately maintained on the faith of repeated trials in Germany, that belladonna in frequent small doses is endowed with the singular and unaccountable property of preventing the invasion of scarlatina. Many instances of its efficacy as a prophylactic have been recorded both in Germany and France. The alleged property has however been generally disbelieved in this country, mainly, perhaps, in consideration of the individual who first announced it, and who made use of the facts in his own way to support his wild theories respecting Homœopathy. But, as the treatment is simple and safe, it seems irrational to decline giving it a fair trial, so long as there are hundreds of public institutions for children in Britain that every now and then are overrun and decimated by scarlatina.

The only medicinal use of Atropia is for dilating the pupil. It does not irritate the eye when introduced under the lid, as the extract often does; very minute doses occasion great dilatation, which continues some days (Reisinger.) Mr Walker of this city dissolves two grains in an ounce of water with a few drops of acetic acid, and applies a single drop of this solution to the conjunctiva. Dilatation of the pupil commences in twenty minutes, is complete in about four hours, and lasts from two to three days. A single drop of the juice of the fresh root has the same effect.

The dose of the extract for internal use has not been well fixed and must vary with its quality. From one to five grains of good

extract is probably a medium dose as an anodyne. For warding off scarlatina a solution of five grains in an ounce of cinnamon-water is given in the dose of fifteen drops twice or thrice a-day to children about ten years old.

BENZOINUM, *E. L. D.* *Concrete balsamic exudation of Styrax benzoïn (Dryand. in Ph. Trans.—W. Spr.)* *Benzoin.*

TINCTURA BENZOÏNI COMPOSITA, E. L. D.

PROCESS, *Edin.* Take of
Benzoïn in coarse powder, four ounces;
Peru-balsam, two ounces and a half;
East-Indian aloes, half an ounce;
Rectified spirit, two pints;
Digest for seven days, pour off the clear liquor, and filter it.

PROCESS, *Lond. Dub.* Take of
Benzoïn, three ounces and a half;
Purified storax, two ounces and a half;
Aloes, five drachms;
Rectified spirit, two pints;
Macerate for fourteen (seven, D.) days, and then filter.

FOR. NAMES.—*Fren.* Benjoin.—*Ital.* Belzuino.—*Span.* Benjui.—*Port.* Beijoim.—*Ger.* Benzoë.—*Swed.* Benzoin.—*Dut.* Benzoin.—*Dan.* Benzöe.—*Russ.* Rosnoy ladon.—*Arab.* Liban.—*Tam.* Malacca sambranie.—*Hind.* Loobau.

FIGURES of Styrax Benzoïn in Nees von E. 211.—Hayne, xi. 21.—Phil. Trans. lxxvii. 308.—Steph. and Ch. iii. 112.

BENZOÏN was long known in European commerce before its source was ascertained. In 1787 Dryander described the tree which produces it.

Natural History.—This is a native of the islands of Borneo and Sumatra, the *Styrax Benzoïn* of most botanists, a plant of Decandolle's natural family *Ebenaceæ,* and of the *Styraceæ* of Lindley, and belonging to the class and order *Decandria Monogynia* in the Linnean arrangement. It grows to the height of seventy or eighty feet when not injured by tapping; but the process of collecting its balsam kills it before it is many years old. Benzoïn is obtained in Sumatra from trees about four years old, by making incisions in the bark and allowing the exudation to remain for three months. New incisions are made when the exudation is removed; and four successive operations are thus practised, after which the tree is exhausted and commonly dies. The produce of the first incisions is considered the best, and is alone transported to Europe. It is called *Head* by Europeans, *Pahong* by the natives. The others are termed *India-head* and *Belly*, and are of inferior quality (Low in Journ. Asiat. Soc. ii.) One tree yields only about a pound and a quarter.

Chemical History.—There are two sorts of Benzoïn in the English market, commonly called First and Second, or Fine and Coarse. The former has an amygdaloidal structure, consisting of milk-white spots on a red ground; the latter is more uniform and has a dingy dark reddish-brown or almost black colour. Both are firm, brittle, and pulverizable, about 1.068 in density, of an agreeable balsamic odour when rubbed, and of a sweetish, balsamic, resinous taste. Benzoïn takes fire upon burning fuel, and consumes with the discharge of a thick irritating smoke; but if

heated in close vessels, benzoic acid rises in large quantity along with a fragrant empyreumatised oil, and condenses in thin tabular crystals. Boiling water takes from it a little benzoic acid, alcohol dissolves it entirely; and so do rectified spirit and ether. Nitric acid, aided by heat, dissolves it with violent action, and the solution deposits benzoic acid. Acetic acid also dissolves it, with the disengagement of its benzoic acid. Boiling solution of potash dissolves it entirely; and if sufficiently concentrated, may form crystals of benzoate of potash on cooling. The amygdaloidal benzoïn consists of 80.7 per cent of resin, 19.8 benzoic acid, and 0.2 moisture; brown benzoïn of 78.5 resin, 19.7 benzoic acid, and 1.6 of extract and impurities (Stolze). There is a mere trace of volatile oil in each. It would appear from this analysis, that the coarse kind is as good as the fine for making benzoic acid; and I have been assured by a wholesale dealer that some manufacturing chemists find it even more productive. In some samples the benzoic acid amounts to no more than 14 per cent (Kopp.) The resinous matter consists essentially of two resins, one soluble, the other insoluble, in ether.

Actions and Uses.—Benzoin, like other resinous substances, is a stimulant. It has been long held to possess expectorant and specific properties in chronic pectoral complaints, and constitutes a material part of most nostrums for these affections. Its reputation however has greatly declined of late years; and few now conceive it to be of much use, except as an agreeable addition to tinctures and mixtures for improving their taste and odour. Its best form is that of the Compound Tincture of Benzoïn of the three Pharmacopœias,—a modification of a celebrated specific in all kinds of coughs, called Friar's-balsam. The reputation of the balsam as a pectoral remedy has been also transferred to its acid; which accordingly has a place in several officinal formulæ. But the properties assigned to it are very problematical. It is much used in the composition of pastilles for fumigation. An approved preparation of the kind consists of powder of benzoin 16 parts, tolu-balsam 4, sandal-wood 4, labdanum 1, charcoal 48, nitre 2, tragacanth 1, and gum-arabic 2, well mixed together, then made into a strong paste with 12 of cinnamon-water, formed into little cones, and dried with a gentle heat (Henri and Guibort.)

The dose of its only preparation *Tinctura benzoïni composita*, E. L. D. is fl. dr. i. ad fl. dr. ii.—*Acidum Benzoïcum.* See that article.

BERGAMOTAE OLEUM, *E.* BERGAMII OLEUM, *L.*

Volatile oil of the rind of the fruit of Citrus Limetta, Risso, in Ann. du Mus. xx. DC. (Edin.)—of Citrus Limetta Bergamium, DC. obtained by distillation (Lond.) Oil of Bergamot.

For. Names.—*Fren.* Bergamotte; Huile de Bergamotte.—*Ital.* Bergamotta; Oleo di bergamotta.—*Ger.* Bergamottöl.—*Dan.* Bergamotolie.

Figure of Citrus limetta in Risso, Ann. du Mus. xx. tab. ii.

THE BERGAMOT is one of the fruits of the genus Citrus, belonging to the same groupe with the lime, and arranged with it by Risso under the name of *C. Limetta*. The plant belongs to the natural family *Aurantiaceæ* and to the Linnæan class and order *Polyadelphia Polyandria*. It thrives in the south of Europe, and especially near Nice. It is distinguished from the sweet-orange, bitter-orange, and lemon trees chiefly by having wingless leaf-stalks. The fruit is roundish or ovate, and provided with a boss at the end farthest from the fruit-stalk. Its rind has a very fine peculiar fragrance, and its pulp is slightly acid and bitterish. The rind is studded with vesicles filled with volatile oil, which may be obtained by grating off the outside of the rind and subjecting it to pressure, or by distilling it with water. One hundred bergamots of Nice yield two ounces and a half of oil by expression (Raybaud). This is Oil of bergamot, a pale yellowish oil, of rich fragrance, resembling that of the lemon and citron. Its density is 888. It becomes concrete at the freezing point of water. It has not yet been subjected to chemical examination. It is much employed in perfumery, and for flavouring liqueurs. The London and Edinburgh Colleges have lately introduced it into the Pharmacopœias as a convenient oil for imparting an agreeable taste to mixtures. It possesses the same medicinal properties with the oil of lemons.

BISMUTHUM, *E. L. D.* *Bismuth.*

TESTS, *Edin.* Entirely soluble in nitric acid with the aid of heat; and the solution is colourless or nearly so, and deposites a white powder when much diluted with cold water.

TESTS, *Lond.* Entirely soluble in diluted nitric acid; and the solution when subnitrate of bismuth is thrown down from it by ammonia, is colourless. Density 9.8.

FOR. NAMES.—*Fren.* Bismuth.—*Ital.* Bismuto.—*Span.* Bismuto.—*Ger.* Wismuth.—*Swed.* Wismut.—*Dan.* and *Russ.* Vismut.

Chemical History.—BISMUTH was long confounded with tin, antimony and lead, till Agricola early in the sixteenth century distinguished it from other metals. It occurs chiefly native, but sometimes united with arsenic, copper, silver, sulphur, &c. The metal of commerce is obtained from native bismuth, which is purified by fusion. It has an irregularly fibro-lamellar texture, considerable brilliancy, and a white colour, intermediate between that of tin and zinc, and which acquires under long exposure a faint yellowish or reddish tint. Its density is variously stated betwixt 9.80 and 10.0. It is hard, but pulverizable. It fuses about 470° and sublimes at a full-red or low-white heat. It is attacked with difficulty by sulphuric or muriatic acid, but readily by diluted nitric acid, with the discharge of nitric oxide gas; and a solution is obtained, from which, by the free addition of water, an insoluble basic salt is thrown down, commonly called Magistery of Bismuth.

Adulterations.—Bismuth is apt to contain copper and iron, either of which, but particularly the latter, renders it comparatively unfit for making the substance to be next mentioned, the trisnitrate of

bismuth. Both impurities may be detected by the action of ammonia, which throws down from a solution of that salt a white precipitate in a colourless fluid, if the bismuth be pure,—but occasions a yellowish precipitate if iron be present in material proportion, and leaves a blue liquid if there be any copper. The presence of arsenic may be detected by Marsh's apparatus.

Bismuth is used only for preparing the next compound.

BISMUTHUM ALBUM, *E.* BISMUTHI TRISNITRAS, *L.* BISMUTHI SUBNITRAS, *D.* *Trisnitrate of Bismuth.*

TESTS, *Edin.* It forms a colourless solution with nitric acid, and without effervescence; not subject to adulteration.

TESTS, *Lond.* Soluble in nitric acid entirely and without effervescence: Diluted sulphuric acid occasions no precipitate.

PROCESS, *Edin.* Take of
Bismuth in fine powder, one ounce;
Nitric acid (Dens. 1380) 1½ fluidounce;
Water, three pints.
Add the metal gradually to the acid, favouring the action with a gentle heat and adding a very little distilled water so soon as crystals or a white powder begin to form. When the solution is complete, pour the liquid into the water. Collect the precipitate immediately on a calico filter, wash it quickly with cold water, and dry it in a dark place.

PROCESS, *Lond.* Take of
Bismuth, one ounce;
Nitric acid one fluidounce and a-half;
Distilled water, three pints.
Dilute the acid with a fluidounce of the water and dissolve the bismuth in it; pour off the solution, add to it the rest of the water, and set the whole aside till the powder settle: pour off the liquid, wash the trisnitrate of bismuth with distilled water, and dry it with gentle heat.

PROCESS, *Dub.* Take of
Bismuth in powder, seven parts;
Diluted nitric acid, twenty parts;
Distilled water, a hundred parts.
Add the bismuth to the acid by degrees, and dissolve it with a gentle heat: add the solution to the water, let the precipitate settle, wash it with distilled water, and dry it with a gentle heat.

FOR. NAMES.—*Fren.* Sous-nitrate de bismuth; blanc de fard.—*Ital.* Sotto-nitrato di bismuto; Magistero di bismuto.—*Ger.* Basisch salpetersaures Wismuth-oxyd; Wismuth-weiss.—*Russ.* Azotnokisloi vismut.

THIS preparation of bismuth, the only one now used in medicine, has been known since the seventeenth century, when the secret of preparing it was purchased by Lemery. It was long termed Magistery of Bismuth; after the reform of chemical nomenclature it was considered and called an Oxide, but was subsequently found to be a basic nitrate and therefore named Subnitrate of bismuth. It appears from the researches of Geiger and others to consist of three equivalents of oxide to one of nitric acid, and is consequently termed by the London College in its new Pharmacopœia the Trisnitrate of Bismuth. The Edinburgh College, to avoid the fluctuations of chemical language, has adopted the old and convenient name of White Bismuth. The term oxide, by which it is commonly known in the shops and prescribed in medical practice, is quite inadmissible.

Chemical History.—The conditions for success in preparing white bismuth are more precise than might appear from the limited instructions of the London and Dublin Colleges. The two principal objects are to obtain bismuth sufficiently free of impurities which would impart colour to the preparation, and to prevent the pulve-

rulent precipitate produced by water from putting on the crystalline form, as it is very apt to do. The former point must be secured by means of the tests mentioned under the head of bismuth; the latter by throwing the solution of the nitrate into a large quantity of water, and not allowing the precipitate to remain long in contact with it. The actions in the process of the Colleges are simple. The bismuth being oxidated at the expense of the nitric acid, nitric oxide gas is given off, and the oxide forms a salt with the remaining acid. The nitrate thus obtained however cannot resist the decomposing action of water; so that on this fluid being freely added, most of the oxide of bismuth falls down with a small proportion of the nitric acid, while a strongly acid solution of a little bismuth remains.

The trisnitrate of bismuth, or white bismuth, is a heavy white powder, which becomes darkish under the action of light if it contain any silver, or be exposed when moist in contact with paper. It is also blackened by sulphuretted-hydrogen. It is almost tasteless and very insoluble in water, but easily soluble in nitric acid. Different accounts have been given of its composition. Some allege that it contains four equivalents of oxide, one of acid, and two of water (Grouvelle). But the most exact analysis is probably that of Geiger, who found it to be composed of three equivalents of oxide of bismuth and one of nitric acid ($3BiO+NO^5$),—and consequently of 237 of base and 54.15 of acid.

Adulterations.—What is met with in the shops of this country is little subject to adulteration; but it is said to be sometimes mixed with earthy carbonates or carbonate of lead. For the discovery of such impurities the London College has indicated the effervescence caused on dissolving it in nitric acid, and the precipitation of this solution with sulphuric acid; the latter of which properties indicates the presence of lead. The Edinburgh College has considered it sufficient to point out that the powder must be soluble without effervescence in diluted nitric acid.

Actions and Uses.—White bismuth was introduced into medical practice towards the close of last century by M. Odier of Geneva as an anodyne and calmative in certain forms of dyspepsia. The nature of its action is rather obscure; but its therapeutic effects in painful dyspepsia are undoubted. In cases of dyspepsia connected with irritability of the stomach, and characterized by pain after meals, heartburn, vomiting speedily after food is taken, and pyrosis, it is often of great service when administered about half an hour before meals. From frequent observation I can add my own testimony to that of others in its favour; and I am at a loss to understand why some practitioners undervalue it, unless it be, that the remedy is not unfrequently given as a tonic in dyspepsia depending on loss of tone and probably defective secretion of gastric juice, in which it is comparatively of little service. The most approved manner of prescribing it is in doses of five or six grains, with as

much aromatic powder. I have also seen it serviceable in chronic diarrhœa from irritability of the mucous membrane in nervous females. United with opium and powder of galls in the proportion of equal parts of each ingredient, and made into an ointment with sufficient axunge, it forms one of the best applications for painful hemorrhoids, where these may admit of treatment without an operation.

The only officinal preparation is the *Pulvis bismuthi albi; P. bismuthi trisnitratis*, L.; *P. bismuthi subnitratis*, D. gr. iv. ad gr. viij. repeatedly.

BITUMEN, *D.* See *Petroleum.*

BONPLANDIA TRIFOLIATA, *D.* See *Cusparia.*

BORAX, *E. L. D.* See *Sodæ Boras.*

BOSWELLIA SERRATA, *D.* See *Olibanum.*

BROMINEUM, *L.* *Bromine.*

TESTS, *Lond.* It evaporates at a gentle heat, exhaling acrid fumes: It is little soluble in water, more so in alcohol, most in ether: Its density is 3.0.

FOR. NAMES.—*Fren.* Brome. *Ital.* Bromo.—*Ger.* Brom.—*Russ.* Brom.

THE medicinal virtues of BROMINE and its compounds have hitherto been scarcely so well established as to warrant its introduction into a national Pharmacopœia. This substance was discovered in 1826 by M. Balard. It is met with, in small proportion only, in sea-water, in some marine plants, in the water of the Dead Sea, in some kinds of rock salt, and in many mineral springs, of which the most remarkable are Kreuznach in Prussia and Ashby-de-la-zouch in Leicestershire.

Chemical History.—It is obtained from the mother-liquors of sea-water or mineral springs by a variety of processes. Balard separated it from the liquor left in manufacturing salt from sea-water, by first passing through it a stream of chlorine-gas, which decomposes the hydrobromate of magnesia in solution,—then agitating the brown fluid with successive portions of ether to dissolve out the disengaged bromine,—next agitating the etherial solution with solution of potash, which converts the bromine into colourless bromide of potassium and bromate of potash, and at the same time dissolves them,—next evaporating the saline solution to dryness and igniting the residuum,—and lastly heating this in a retort with black oxide of manganese and slightly diluted sulphuric acid. Bromine then rises in the form of very acrid vapours, which must be condensed in a receiver by means of ice or snow. Löwig obtained it more simply from the mineral water of Kreuznach by precipitating earthy salts from the mother liquor

with sulphuric acid, evaporating the filtered fluid to dryness, dissolving the residue in its own weight of water, and heating this solution in a retort with sulphuric acid and black oxide of manganese (Geiger.)

Bromine is a dark brownish-red, opaque, very heavy fluid, volatile, concrete at —4° F, vaporizable at 116°, sparingly soluble in water, more so in rectified spirit, and easily soluble in ether. Its vapour, which is with great difficulty confined, has an orange-red colour, and a peculiar, insupportably intense, acrid odour, whence is derived its scientific name,—from βρωμος, *fœtor*. In its chemical relations it bears the closest analogy to iodine and chlorine, so that these need not be detailed in the present place. The principal purpose for which it is used in medicine is for preparing the bromide of potassium (see *Potassii bromidum*). Its atomic weight is 78.4; its density 2.99.

Actions.—It is a very powerful corrosive. A minute proportion of its vapour in the air causes violent coughing and sneezing, and is very apt to induce coryza and bronchial inflammation. It is consequently a dangerous poison either in the liquid or gaseous form. It is supposed to be a tonic deobstruent in small doses, more especially in the form of an alkaline bromide, as stated under *Potassii bromidum*. It may be itself given in solution in forty parts of water; of which the dose is five or six drops.

BUBON GALBANUM, *D.* See *Galbanum.*

BUCKU, *E.* DIOSMA, *L.* DIOSMAE CRENATAE FOLIA, *D.* *Leaves of various species of Barosma, W. in Hort. Berol.* (*Edin.*) *Leaves of Diosma crenata*, (*Lond. Dub.*)—*Bucku.*

INFUSUM BUCKU, E. D. INFUSUM DIOSMAE, L.

PROCESS, *Edin. Lond. Dub.* Take of
Bucku (Diosma, L.) one ounce (half an ounce, D.);
Boiling water, one pint (eight fluidounces, D.)
Infuse for four (two, E.) hours in a covered vessel, and strain through linen or calico.

TINCTURA BUCKU, E. D.

PROCESS, *Edin. Dub.* Take of
Bucku, five (two, D.) ounces;
Proof-spirit, two pints (one old wine pint, D.)
Digest for seven days; pour off the clear liquor, and filter it.
This tincture may be also made quickly and conveniently by percolation. *Edin.*

FOR. NAMES.—*Fren.* Bucco; Buchu.—*Ger.* Buccoblätter; Götterduft.

FIGURES of Diosma crenata in Steph. and Ch. iii. 121. Diosma serratifolia in Bot. Mag. 456. Diosma crenulata in Bot. Mag. 3113.

THIS drug furnishes a good illustration of the inconvenience of attempting a correct botanic nomenclature of the articles of the Materia Medica. It has been known in Britain for about twenty years under its original Hottentot name of Bucku or Buchu; but the London College had scarcely admitted it into their Pharmacopœia under the botanical name of Diosma, before botanists disco-

vered that the plant or plants from which it is obtained must be removed into a new genus, now named *Barosma.*

Natural and Chemical History.—Although the Dublin and London Colleges admit only one officinal species as producing the Bucku of the shops, it is well ascertained that several species have similar properties; and in what is brought to this country two species may be frequently seen, namely *B. crenata* and *B. serratifolia*,—the latter indeed perhaps more frequently than the former. These and several other species are common in Southern Africa in a limited district near the Cape of Good Hope. They belong to Linnæus's class and order *Pentandria Monogynia*, to the subdivision *Diosmeæ* of Decandolle's *Rutaceæ* in the Natural arrangement, and to Lindley's order *Rutaceæ*. They are all small shrubs, which emit a heavy powerful odour, whence the name of the genus (βαρυς οσμη). The officinal part is the leaf. That of *B. crenata* resembles the leaf of the box in size, thickness and form, but has a crenated or serrated margin, is studded with little oil-vesicles, and possesses a strong odour allied to pennyroyal, together with a corresponding aromatic taste, unattended with bitterness, astringency, or acridity. The odour is preserved for some years if the leaves be kept with ordinary care. They impart their sensible properties to water, and hence the *Infusum bucku* is one of the officinal forms. Alcohol also dissolves out all their active principles, so that a *Tinctura bucku* is likewise admitted into the Pharmacopœias. A watery extract was at one time in use in this country; but it is not a scientific preparation, being necessarily destitute of the chief active principle, a volatile oil. The leaves have been analysed by Gadet de Gassicourt, who obtained from them 0·6 per cent of volatile oil, 21·2 of gum, 5·2 of extract soluble in water and in alcohol, 1·1 of chlorophyll, and 2·1 of resin. The fresh leaves must contain more oil. This oil is of a yellowish-brown colour and a powerful penetrating odour.

Actions and Uses.—Linnæus made the bucku plant known to European botanists in his *Amœnitates Academicæ*. But it was not used as a remedy, till Burchell the African traveller mentioned it as an article he had often seen the Hottentots employ with singular advantage as a vulnerary, and in the treatment of diseases of the urinary organs. More precise information was subsequently given by Dr Jackson (Calc. Med. and Phys. Trans. i.) and by Dr M'Dowall (Trans. Dub. Coll. Phys. iv.) It must be a stimulant, especially in the fresh state, by reason of its volatile oil; and it is also probably an antispasmodic, as the oil is highly diffusible. Dr Jackson found the infusion serviceable in allaying irritation of the bladder and urethra attending gravel. Dr M'Dowall used it with success in catarrh of the urinary bladder and incontinence connected with diseased prostate; and he generally observed a diuretic action, but no other distinct physiological effect. The Hottentots use it internally for chronic rheumatism. They also employ

it as an embrocation in the same disease, and as a vulnerary in the form of vinegar for all manner of injuries.

The doses of the officinal preparations are, *Infusum Buchu*, E. D.* *Infusum Diosmæ*, L. unc. ii. ad unc. iv. *Tinctura Buchu*, E. D. dr. i. ad dr. ii.

CAJUPUTI, *L.* CAJUPUTI OLEUM, *E.* CAJEPUT, *D.*

Volatile oil of the leaves of Melaleuca minor, Smith in Rees' Cycl. —DC. (Edin. Lond.) of Melaleuca Leucadendron, L. W. DC. (Dub.) Oil of Cajeput.

FOR. NAMES.—*Fren.* Huile de Cajeput.—*Ger.* Cajaputöl.—*Russ.* Caeputovoe maslo.—*Tam.* Kayapoottie tayilam.

FIGURES of Melaleuca minor as Melaleuca Cajuputi by Roxb. in Med. Bot. Trans. 1828.—Steph. and Ch. ii. 84.—as Arbor alba minor in Rumph. Amboyn. ii. Tab. xvii.—as Melaleuca Leucadendron in Hayne, x. 9.—Nees von E. 300.

Melaleuca Leucadendron in Med. Bot. Trans. 1828.—Nees von E. Suppl. 91.

Natural History.—OIL of CAJEPUT has been known in Europe for above two centuries. Rumphius first described the tree which produces it under the name of *Arbor alba*, a literal translation of one of its Malay names, Cayu-puti, or White-tree. Several botanists have described it in more recent times; but the species was generally mistaken till the researches of Sir J. Smith, published in 1819 in Rees' Cyclopædia, and those of Roxburgh first made public after his death by Mr Colebrooke in the Medico-Botanical Transactions for 1828. Rumphius accurately distinguishes two closely allied species under the names *Arbor alba major* and *minor*. The former was generally considered the source of cajeput-oil, probably because the Malays apply to it chiefly the name of Cayuputi,—its more correct Malay name however being Cayu-Gelam. This is the *Melaleuca Leucadendron* of modern botanists, an inhabitant of most of the Molucca Isles, and abounding on Amboyna, but more especially on Boerou and Ceram. It appears however from the inquiries of Smith and of Roxburgh that the usual reference to this species is a mistake; that the *Arbor alba major* of Rumphius, contrary to his statement, has no odour; and that cajeput-oil is the produce only of his *Arbor alba minor*, the *Melaleuca minor* of Smith as well as Decandolle, or *M. Cajuputi* of Roxburgh, Lindley, and others. This plant belongs to the Linnæan class and order *Polyadelphia Icosandria*, and to the Natural family *Myrtaceæ*. It is a crooked tree, about twenty feet high, a native of several of the Molucca Isles, especially of Boerou and Manipa, and also of the southern part of Borneo, but not of Amboyna. Like the other species, it is sometimes called by the natives Cayu-puti, but its correct Malay name is Daun-Kitsjil. It closely resembles the *M. Leucadendron*. But it differs in its stature being much less,—it leaves three or five-nerved and silky while young,—and its flower-spike shorter, broader, and not interrupted. The *M. Leucadendron* is fifty or sixty feet high; its flower-spike is

interrupted; and its leaves are five nerved, always smooth, destitute of odour, and incapable of yielding oil by distillation (Roxburgh).

Chemical History.—Cajeput-oil is obtained from the leaves of *M. minor*, which are collected for the purpose in autumn, allowed to steep for a night in water, and then distilled in copper vessels. It is exported to Europe in green-glass bottles. It is a very liquid oil, which possesses a grass-green colour, a strong odour partaking both of camphor and of cardamom, and a corresponding taste, succeeded by an impression of coolness. The green colour is not essential, as it may be removed by distillation; but it is not owing to copper as was once thought. The density of cajeput-oil varies from 914 to 927. It boils at 343°. When distilled, it yields first a colourless oil of the density 897° and then a green oil, denser, weaker in odour, but more acrid. It is entirely soluble in alcohol. Sulphuric and nitric acids have little action on it. It is composed of 77.92 per cent of carbon, 11.69 hydrogen, and 10.39 oxygen,—that is 10 equivalents of carbon, 9 hydrogen, and 1 oxygen (Blanchet).

Adulterations.—It is said to be often counterfeited, especially on the continent; and the usual imitation consists of rosemary-oil distilled from camphor, bruised cardamom-seeds, and water. The best character of the genuine oil is that it burns entirely away without leaving any residue (Hagen). It is sometimes adulterated with copper. This may be detected by a residuum being left after combustion, which, when dissolved in nitric acid, gives a violet solution with ammonia added in excess.

Actions and Uses.—Cajeput-oil is a powerful diffusive stimulant, much esteemed in the islands of the Indian ocean as a topical remedy for rheumatism, and internally as a panacea for most maladies. It is a good antispasmodic in nervous diseases, especially hysteria. It had for a time in India and Europe a high reputation in malignant cholera; but it is not more effectual than other diffusive stimulants. Rumphius thought it a good sudorific.

Its dose is four or five drops, and it is commonly given in sugar.

CALAMINA, *E. L.* See *Zinci Carbonas.*

CALAMUS AROMATICUS, *E.* ACORUS, *L.* *Rhizoma of Acorus Calamus, (var. α, vulgaris, L. W. Edin). Sweet flag.*

FOR. NAMES.—*Fren.* Acore vrai.—*Ital. Span.* and *Port.* Calamo aromatico.—*Ger.* Gemeiner Kalmus.—*Dut.* Kalmus.—*Swed.* Kalmusrot.—*Dan.* Calmus.—*Russ.* Aur; Kalamus.—*Arab.* Kusset alderirch.—*Pers.* Vudge.—*Tam.* Vassamboo.—*Hind.* Bach.

FIGURES of Acorus Calamus in Nees von E. 24.—Hayne, vi. 31.—Eng. Bot. 356.

THE modern *Acorus Calamus* was the Ακοϱον of Dioscorides, and probably the Καλαμος μυϱεψικος of Hippocrates, and not the Καλαμος

αρωματικος of the former author, which seems to have been a species of *Andropogon*. The use made of it in classical times, and the circumstance that it is one of the most powerful of indigenous aromatic roots, retain it still in the Pharmacopœias, although it is scarcely put to any use.

The plant belongs to the Linnæan class and order *Hexandria Monogynia*, and to the natural family *Aroideæ* of Decandolle's arrangement, or *Acoraceæ* in that of Lindley. It grows in wet places in this country. It has a creeping root-stock, which pushes up at intervals leaf-like stems about three feet high. The root-stock, its officinal part, is about the thickness of the thumb, rather flat, spongy, and provided with numerous sheath-like ringed appendages. It has a peculiar aromatic odour, and an analogous, bitterish, acrid taste. Its taste and odour are perfectly preserved in the dried rhizoma. It contains starch, gum, resin, volatile oil and other unimportant ingredients (Trommsdorff.)

It is a stimulant and tonic like other aromatics. It may be given in powder, infusion, or tincture.

The dose of the *Pulvis calami* is gr. xx. ad dr. i.

CALCII CHLORIDUM, *L.* See *Calcis Murias*.

CALCIS CARBONAS PRECIPITATUM, *D.* *Pure Carbonate of Lime.*

PROCESS, *Dub.* Take five parts of solution of muriate of lime; add three parts of carbonate of soda dissolved in twelve parts of distilled water; wash the precipitate thrice with water by subsidence and effusion; dry the precipitate on a chalk-stone and paper.

CRETA, *E. L. D.* *Friable Carbonate of Lime: Chalk.*

TESTS, *Lond.* It is entirely soluble in diluted hydrochloric acid, with effervescence; and the solution, when boiled, does not yield any precipitate with ammonia.

CRETA PRÆPARATA, *E. L. D.* *Chalk finely pulverized by lævigation.*

TESTS, *Edin.* A solution of 25 grains in ten fluidrachms of pyroligneous acid, when neutralized by carbonate of soda, and precipitated by 32 grains of oxalate of ammonia, continues precipitable after filtration by more of the test.

PROCESS, *Edin. Dub.* Take any convenient quantity of chalk. Triturate it well with a little water; pour it into a large vessel nearly full of water, and agitate briskly; let it rest for a short time, and pour the milky water into another vessel, in which the fine suspended chalk is to be left slowly to subside. Repeat this process with the coarsely-powdered chalk, which subsided quickly in the first vessel; collect the fine powder in the second vessel on a filter of linen or calico and dry it (on a bibulous stone or paper, D.)

PROCESS, *Lond.* Take a pound of chalk and a sufficiency of water. Triturate the chalk with a little of the water to a fine powder: Throw this into a large vessel with the rest of the water; then agitate; and in a short time pour the turbid supernatant water into any vessel, to rest and settle: Pour off the water, and dry the powder for use.

Oyster-shells may be prepared in the same way after being cleaned, and washed with boiling water.

MISTURA CRETAE, E. L. D.

PROCESS, *Edin.* Take of
Prepared chalk, ten drachms;
Pure sugar, five drachms;
Mucilage, three fluidounces;
Spirit of cinnamon, two fluidounces;
Water, two pints.
Triturate the chalk, sugar, and mucilage together; and then add gradually the water and spirit of cinnamon.

PROCESS, *Lond.* Take of
Prepared chalk, half an ounce;
Sugar, three drachms;
Mucilage of gum-arabic, a fluidounce and a-half;
Cinnamon-water, eighteen fluidounces.
Mix them.

PROCESS, *Dub.* Take of
Prepared chalk, half an ounce;
Pure sugar, three drachms;
Mucilage of gum-arabic, a fluidounce;
Water, one (old wine) pint.
Mix them.

PULVIS CRETAE COMPOSITUS, E. L. D.

PROCESS, *Lond. Dub.* Take of
Prepared chalk, half a pound,
Cinnamon, four ounces;
Tormentil-root, and
Gum-arabic, of each three ounces;
Long-pepper, half an ounce.
Reduce them to powder apart, and then mix them.

PROCESS, *Edin.* Take of
Prepared chalk, four ounces;
Cinnamon, in fine powder, one drachm and a half;
Nutmeg, in fine powder, a drachm.
Triturate them well together.

PULVIS CRETAE OPIATUS, E.

PULVIS CRETAE COMPOSITUS CUM OPIO, L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Compound chalk powder, six ounces (and a half, L. D.)
Powder of opium, four scruples.
Mix them together thoroughly.

TROCHISCUS CRETAE, E.

PROCESS, *Edin.* Take of
Prepared chalk, four ounces;
Gum-arabic, one ounce:
Nutmeg, one drachm;
Pure sugar, six ounces.
Reduce them to powder, and beat them with a little water into a proper mass for making lozenges.

MARMOR, *E. L. D.* *Massive crystallized carbonate of lime. White marble.*

TESTS, *Edin.* A neutral solution in diluted nitric acid, precipitated by an excess of oxalate of ammonia and filtered, yields no white precipitate with phosphate of ammonia.

TESTS, *Lond.* White. Soluble with effervescence in diluted hydrochloric acid; and the solution yields no precipitate with ammonia or solution of sulphate of lime.

TESTAE, *L. D.* *Shell of Ostrea edulis.* *Oyster-shells.*

TESTAE PREPARATAE, L.

PROCESS, *Lond.* To be prepared in the same way with prepared chalk. See *Creta præparata* above.

FOR. NAMES.—*Calcis Carbonas.*—*Fren.* Carbonate de chaux.—*Ital.* Carbonato di calce.—*Ger.* Kohlensaurer kalk.—*Russ.* Uglekislaia Isvest.
Creta. *Fren.* Craie.—*Ital. and Span.* Creta.—*Ger.* Kreide.—*Dut.* Krijt.—*Swed.* Krita.—*Dan.* Hvid kride.—*Russ.* Mel.—*Arab.* Tyn abyaz.— *Pers.* Gil sifid.—*Tam.* Simie chunamboo.
Marmor.—*Fren.* Marbre.—*Ital.* Marmo.—*Span.* Marmol.—*Ger.* Weisse marmor.—*Dut.* Marmar.—*Swed.* Hwit marmor.—*Russ.* Mramor.

Natural History.—CARBONATE OF LIME is one of the most abundant of all natural productions. In the mineral world, it constitutes a part of very many common compound minerals. In the pure state, or nearly so, it forms vast beds and veins amidst the strata of almost all ages composing the crust of the earth, whether primitive, transition, secondary, or tertiary. It exists largely in many

soils. It is found in a state of solution in many mineral springs; and in some so abundantly, that in the course of ages they have formed by gradual deposition extensive stony formations, and even in a few months will thickly encrust objects immersed in them. It constitutes the chief part of the shell of testaceous animals, as well as of egg-shells, and a considerable proportion of the bones of quadrupeds, birds and fishes. It is found likewise in the ashes of most vegetable substances. Its most important varieties are limestone, calc-spar, chalk, marble, and marine shells. But the only varieties now used in medicine are white marble, the purest species of limestone,—chalk,—and oyster-shells. The last article has been expunged from the Edinburgh Pharmacopœia; and there is no reason for any British College retaining it, except that in some places it is more easily obtained than other forms of carbonate of lime.

Chemical History. — Although the Colleges have indicated WHITE MARBLE generically as admissible for pharmaceutic purposes, every species of white marble is not available. The marble of St Gothard and that of Iona, which belong to the Dolomitic limestones, contain a considerable proportion of magnesia, and are therefore unfit for pharmaceutic use. These are accordingly excluded by the tests for pure marble given by the Colleges of London and Edinburgh. The finest and purest variety is that of Carrara, sometimes called Statuary marble. Of the hard carbonates of lime met with in this country, calcareous spar, which in some places is found very pure in large veins, is alone serviceable except in coarse operations. White marble is known from most other minerals by its pure white colour, its crystalline structure, and the effervescence it presents when touched with muriatic acid. It is tasteless, brittle, pulverizable, unalterable in the air, and insoluble in water or alcohol. When exposed to a full-red heat, it acquires an earthy appearance, and loses about 44 per cent of its weight, owing to the escape of carbonic acid. It consequently then presents all the characters of quicklime (see *Calx*.) It dissolves with effervescence readily in nitric or muriatic, and more slowly in acetic, acid; and sulphuric acid likewise occasions effervescence, but forms an insoluble salt. When quite pure, it consists of one equivalent of acid and base ($CaO + CO^2$); that is 22.12 parts of carbonic acid and 28.5 of lime.

The adulterations of white marble are few in number. The only impurity sometimes present is magnesia. This will be detected, as the London College directs, by dissolving the marble in diluted muriatic acid, and testing the solution with ammonia, which does not precipitate lime, but throws down magnesia. In applying this formula, care must be taken that the muriatic acid be neutralized by the marble, otherwise magnesia will not be thrown down on account of the formation of muriate of ammonia, which prevents it from being precipitated by an excess of ammonia. The Edinburgh College directs lime to be thrown down from a neutral solution

with an excess of oxalate of ammonia; after which, if any magnesia was originally present, it will be precipitated by phosphate of ammonia, or by phosphate of soda with ammonia.

CHALK is found in the newest secondary strata, and constitutes with its subordinate rocks a distinct and peculiar formation. It abounds in many parts of England, and upon the adjacent French coast. There are two kinds of it, hard and soft chalk. Both are alike fit for medical use; but the soft variety is commonly preferred. It has an earthy appearance, a pure white colour, great friability, and no taste. In its relations to air, water, alcohol, heat, and acids, it is identical with white marble. Water charged with carbonic acid dissolves a small quantity of it, and deposits most of it again on being exposed to the air. For medicinal use it is submitted to the process of levigation; which consists in pulverizing it with a little water, agitating the mixture in a large quantity of water, allowing the coarse powder to settle, which it does in a few seconds, and then collecting apart the fine impalpable powder which afterwards slowly subsides. This constitutes the *Creta præparata* of the Pharmacopœias.

Chalk is scarcely ever a perfectly pure carbonate of lime. Most even of its fine qualities contain a little silica and alumina, and the coarser qualities may contain oxide of iron. The London formula of tests represents it to be entirely soluble in muriatic acid. But this is seldom the case, a little silica being usually left undissolved. The presence of alumina is indicated by a white precipitate forming, on the muriatic solution being neutralized by ammonia; and oxide of iron will separate in the same circumstances in yellow flakes. Magnesia is not sufficiently provided against in the London formula, for the reason assigned above in speaking of marble; but chalk is scarcely ever adulterated, at all events materially, with magnesia. The silica, alumina, and hygrometric water together commonly amount, according to my observation, to about ten per cent of the prepared chalk of the shops, but not more if the quality be good. The Edinburgh formula makes allowance for this amount of impurity, but takes no account of the nature of the extraneous matters. A given quantity of chalk being dissolved in pyroligneous acid, for which purpose a considerable excess of acid is useful, as directed by the college,—the lime is thrown down in the neutralized solution by a given quantity of oxalate of ammonia, such as will leave a little lime unprecipitated if there be ninety per cent of pure carbonate of lime in the chalk; and this slight excess of lime is indicated by adding more oxalate of ammonia to the filtered liquor. Should no precipitate then form, the chalk is unusually impure.

The PRECIPITATED CARBONATE OF LIME of the Dublin Pharmacopœia is an unnecessary article of the Materia Medica. It is nothing else than pure carbonate of lime finely divided, and as such has no advantage whatever over good Prepared chalk.

Actions and Uses.—Chalk is used in medicine chiefly as an antacid, and as a medium for aiding the minute division of other drugs. It is much employed as an antacid in acidity of the stomach, in children particularly, and also in most forms of diarrhœa. It is usefully combined for these purposes with aromatics or with opium; and all the Colleges have preparations of the kind in their Pharmacopœias, such as the chalk-mixture, compound-chalk-powder, chalk and opium-powder, chalk-lozenge, and aromatic-confection. For some purposes it is also usefully united with mercury, as in the powder of mercury and chalk of the Pharmacopœias; which however may act as a mercurial. Some employ chalk for drying up the discharges from ulcers and burns, for preventing excoriation from pressure or friction, and in the treatment of various eruptive diseases attended with fluid secretions. But it acts here mechanically alone, and is not in general an eligible remedy. The calmative virtues ascribed by others to chalk independently of its antacid action, as in diarrhœa and irritation of the stomach, are of questionable existence. The medicinal uses of oyster-shells are the same with those of chalk; but they are now very little employed in this country. Marble is not itself put to any use as a medicine; but it is a most important material, as well as chalk, for preparing many articles of the materia medica, such as the officinal compounds of lime, the preparations of ammonia, tartaric and citric acids, and carbonic acid gas for making the alkaline bicarbonates and effervescing waters.

The preparations of chalk used in medicine and their doses are as follows: *Creta præparata*, E. L. D. gr. x. ad dr. i. *Mistura cretæ*, E. L. D. unc. i. ad unc. ii. *Pulvis cretæ compositus*, E. L. D. dr. ss. ad dr. i. *Pulvis cretæ opiatus*, E. gr. v. ad gr. xx. *Pulvis cretæ compositus cum opio*, L. gr. v. to gr. xx. *Confectio aromatica*, L. D. (not E. see *Cinnamomum*), scr. i. ad dr. i. *Trochiscus cretæ*, E. dr. i. ad dr. ii. *Hydrargyrum cum creta*, E. L. D. gr. v. ad gr. xx. See *Hydrargyrum*.

CALCIS HYDRAS, *L.* See *Calx*.

CALCIS MURIAS, *E.* *Hydrated Chloride of Calcium. Hydrochlorate of Lime.*

TESTS, *Edin.* Extremely deliquescent; a solution of seventy-six grains in one fluid-ounce of distilled water, precipitated by forty-nine grains of oxalate of ammonia, remains precipitable by more of the test.

PROCESS, *Edin.* Take of
White marble in fragments, ten ounces;
Muriatic acid of commerce, and
Water, of each one pint.
Mix the acid and water; add the marble by degrees, and when the effervescence is over, add a little marble in fine powder till the liquid no longer reddens litmus; filter and concentrate to one-half; put the remaining fluid in a cold place to crystallize; preserve the crystals in a well-closed bottle. More crystals will be obtained on concentrating the mother-liquor.

CALCII CHLORIDUM, *L.* CALCIS MURIAS, *D.* *Chloride of Calcium.*

TESTS, *Lond.* Colourless, scarcely translucent, hard, brittle, entirely soluble: The solution is not precipitated by ammonia, or chloride of barium, or, when much diluted, by ferrocyanide of potassium.

PROCESS, *Lond.* Take of
Chalk, five ounces;
Hydrochloric acid, and
Distilled water, of each half a pint.
Mix the acid and water; add the chalk to saturation; filter when effervescence ceases; evaporate to dryness; heat the salt in a crucible to fusion, pour it on a smooth clean stone, break it down when cool, and preserve it in a well-closed vessel.

PROCESS, *Dub.* Take any convenient quantity of the liquor remaining after the distillation of Aqua ammoniæ causticæ. Filter it; heat it in an open vessel till a perfectly dry salt be obtained. Keep this in a well-closed vessel.

CALCIS MURIATIS SOLUTIO, E. CALCII CHLORIDI LIQUOR, L.
CALCIS MURIATIS AQUA, D.

PROCESS, *Edin.* Take of
Muriate of Lime (crystallized) eight ounces;
Water, twelve fluidounces.
Dissolve the salt in the water.

PROCESS, *Lond. Dub.* Take of
Chloride of calcium, four ounces (muriate of lime, three parts, D.);
Distilled water, twelve fluidounces (seven parts, D).
Dissolve the salt in the water. Density 1202, D.

FOR. NAMES.—*Fren.* Chlorure de calcium.—*Ital.* Cloruro di calcium.—*Ger.* Chlorcalcium.—*Russ.* Chloristoi kaltsi.

Chemical History.—ACCORDING to the modern theory relative to the constitution of the compounds of chlorine, this element unites with calcium, to form Chloride of calcium,—the fused Muriate of lime of chemists in the early part of the present century. When this salt is dissolved in water, it is held, according to the newest theory, to dissolve simply as chloride of calcium; but according to the older doctrine, it becomes hydrochlorate of oxide of calcium (lime) through decomposition of an equivalent of water. On the solution being sufficiently concentrated, crystals are formed, which contain water of crystallization; and these may be viewed either as chloride of calcium with six equivalents of water, or as hydrochlorate of lime with five equivalents only. These considerations are necessary for understanding the nomenclature of the Colleges. The Edinburgh College has adhered to the old nomenclature, with the view of securing a permanent pharmaceutic name. But the muriate of lime of this College is the hydrated crystallized salt; while the Dublin muriate is the fused salt, without water, and containing about twice as much chloride of calcium.

CHLORIDE OF CALCIUM has been known for several centuries; but Bergmann and Kirwan first ascertained its composition. It exists abundantly in many mineral waters; of which it sometimes constitutes the most active ingredient, as in the springs of Airthrey, Pitcaithley, and Dumblane in Perthshire. It may be obtained from the residuum of various officinal preparations, such as solution of ammonia, spirit of ammonia, and carbonate of ammonia. But it is now chiefly prepared by dissolving marble or chalk in muriatic acid,—a process which must be frequently performed at any rate for obtaining carbonic acid gas in various pharmaceutic processes. The crystallized salt of the Edinburgh College is easily obtained

by concentrating a solution till a pellicle begins to form, and then adding a little boiling water before letting the liquor cool. The fused anhydrous salt is most readily obtained by driving off as much water as possible with the aid of a considerable heat applied to a shallow evaporating basin, and putting the dry residuum in successive portions into a heated crucible; for if it be put all at once into the crucible, the material is apt to froth over. Iron vessels must be avoided, because the salt is rendered black by them.

Chloride of calcium is hard, semitranslucent, and fibrous, of a warm, acrid, bitter, saline taste, excessively deliquescent in the air, fusible at a red heat, and incapable of being sublimed or decomposed by any known elevation of temperature. It is exceedingly soluble in water, and also easily soluble in rectified spirit; in which states it becomes identical with the crystallized salt. In consequence of its strong affinity for water, it reduces a confined space of air to a state of perfect dryness; and thus indirectly removes water from many hydrated substances, if enclosed along with it.

Hydrochlorate of Lime (Muriate of lime; Crystallized chloride of calcium) forms striated, colourless, transparent, six-sided prisms, acutely acuminated, of a cooling, bitter, saline taste, and very deliquescent. At a moderate elevation of temperature it fuses in its water of crystallization. It is soluble in a fourth of its weight of temperate water, and likewise easily in rectified spirit. The watery solution gives a white precipitate with oxalate of ammonia, with the alkaline carbonates, and also, if not too diluted, with the alkaline sulphates. Ammonia does not affect it. Nitrate of silver occasions a precipitate of chloride of silver, as with the muriates generally.——The fused chloride of calcium consists of one equivalent of each of its elements, consequently of 20.1 of calcium and 35.42 parts of chlorine (Ca Cl); and the crystallized salt contains in addition six equivalents of water (Ca Cl + 6 Aq or CaO ClH + 5 Aq), that is 54 parts.

Adulterations.—The crystallized salt is little subject to adulteration. If it contain any alkaline salt, impurity will be indicated in a general way by means of oxalate of ammonia used in the method directed by the Edinburgh College. The fused salt is apt to contain iron; which may be indicated by ferrocyanide of potassium, as directed by the London College,—a blue precipitate being occasioned; but as the fusion reduces the iron to the state of insoluble sesquioxide, it is readily detected and separated by simply dissolving the salt. The presence of magnesia is indicated by ammonia causing a white precipitate.

Actions and Uses.—Chloride of calcium is an irritant poison in large doses. In small doses it is a cathartic. Its cathartic properties in the pure state have not been particularly examined. But it is a convenient remedy of this class when given along with other purgative salts; and it forms almost the only active ingredient of some powerful mineral waters. It was introduced into medicine

towards the close of last century as an alterative tonic for the various forms of struma, and especially as a deobstruent in glandular swellings; but of late it has been superseded for these purposes by iodine and the iodides, and its utility is questionable. It is an important agent in chemistry, being used for concentrating alcohol, for preparing muriate of morphia, as a test for oxalic acid, and in organic analysis.

The dose of the solution, its only officinal form, is *Calcis muriatis solutio*, E. (*Aqua*, D.); *Chloridi calcii liquor*, L. min. xx. ad fl. dr. i.

CALCIS PHOSPHAS PRECIPITATUM, *D.* *Phosphate of Lime.* *Bone-phosphate of lime.*

PROCESS, *Dub.* Take of
Powder of calcined bones, one part;
Diluted muriatic acid, and
Water, two parts of each.

Digest for twelve hours, and filter. Add a sufficiency of solution of ammonia to precipitate the phosphate of lime. Wash this well with water, and dry it.

CORNU, *L. E.* CORNU CERVINI RAMENTA, *D.* *The Horns of Cervus Elaphus.* *Hartshorn-shavings.*

CORNU USTUM, *L.* CORNU CERVINI USTI PULVIS, *D.* *Calcined Hartshorn.* *Bone-earth.*

TESTS, *Lond.* When well burnt, it is almost entirely soluble in nitric acid: From this solution lime is separated by oxalate of ammonia, and phosphoric acid by acetate of lead.

PROCESS, *Lond.* Burn fragments of hartshorn in an open vessel till they are quite white: then pulverize them and prepare them as directed for Prepared Chalk.

PROCESS, *Dub.* Burn fragments of hartshorn till they become white; and then reduce them to very fine powder.

FOR. NAMES.—*Phosphas calcis.*—*Fren.* Phosphate de chaux.—*Ital.* Fosfato di calce.—*Ger.* Phosphorsaurer kalk.
Cornu.—*Fren.* Corne de cerf.—*Ital.* Corno di cervo.—*Span.* Corno de ciervo.—*Port.* Corno de veado.—*Ger.* Hirschhorn.—*Swed.* Hiorthorn.—*Dan.* Hiortetakke.
Cornu ustum.—*Fren.* Corne de cerf calciné.—*Ital.* Fosfato calcareo delle ossa.—*Ger.* Weissgebrannter hirschhorn.

Chemical History.—AT different times in the history of medicine a great variety of drugs were obtained from almost every part of the body of the stag; but the horns are now alone retained in the British Pharmacopœias. They consist in a great measure of phosphate of lime and gelatin, with a little carbonate of lime, amounting to scarcely two per cent of the whole earthy matter. The gelatin may be obtained in part by digesting the shavings of horn in water, or entirely by removing the earthy ingredients with diluted muriatic acid. It forms an excellent variety of nutritive jelly; which at one time was held to possess peculiar restorative virtues. The earthy part of horn may be obtained by simply burning it in an open fire till it become white. With this view it is necessary that the heat be not raised too high, otherwise the surface

undergoes semifusion and vitrification, which impede the combustion of the charcoal in the interior of the fragments, as well as their subsequent pulverization. The product constitutes the Burnt Hartshorn of the Pharmacopœias.

This substance is white, tasteless, brittle and pulverizable. It consists chiefly of phosphate of lime, with a little carbonate of lime, and traces of magnesia, iron, and manganese. An intense white heat fuses it. It is insoluble in water. Nitric, muriatic, and acetic acids dissolve it. From its solution in diluted nitric acid oxalate of ammonia throws down a white precipitate of oxalate of lime, and acetate or nitrate of lead a heavy white precipitate of phosphate of lead. The best test for it is the ammoniacal nitrate of silver; which, if the solution in nitric acid be neutralized so far as is possible without a permanent precipitate being occasioned, will throw down a lemon-yellow phosphate of silver.

The Dublin College has introduced, unnecessarily perhaps, a pure phosphate of lime prepared by precipitating a muriatic solution of burnt bones by ammonia. Its characters do not differ essentially from those just given for burnt hartshorn, except that it forms a much finer and smoother powder than it is possible to obtain from the latter preparation. Various phosphates of lime are known in chemistry. The present variety, usually distinguished by the name of Bone-phosphate, consists of eight equivalents of base and three equivalents of acid ($8\ CaO + 3\ PO^5$); and consequently of 228 parts of lime, and 214.2 of phosphoric acid.

Actions and Uses.—Hartshorn is now used only for preparing Antimonial powder and Burnt-hartshorn. Its earthy matter, as well as the pure bone-phosphate, was at one time considered a useful remedy in rickets and mollities ossium. Its application to these diseases was a theoretical inference from the state of the bones, which are known to be deficient in their earthy constituents. But the theory has never been confirmed by practical experience; and at present the remedy is in disuse. It was customary to give it in powder, in which state a portion would probably be dissolved by the acid juices of the stomach. A better method of administration would be in a state of solution in acetic or muriatic acid.

The doses of its several preparations are: *Cornu ustum*, L. D. dr. ss. ad dr. ii. *Calcis phosphas precipitatum*, D. dr. ss. ad dr. ii.

CALX, *E. L. D.* *Lime.* *Quicklime.*

TESTS, *Edin. Lond.* It is slaked by water. Muriatic acid then dissolves it entirely, without effervescence; and the solution does not precipitate with ammonia.

PROCESS, *Edin.* Heat white marble broken into fragments in a covered crucible at a full-red heat for three hours, or till the residuum, when slaked and suspended in water, no longer effervesces on the addition of muriatic acid.

PROCESS, *Lond.* Take one pound of chalk: break it into fragments, and burn it with a very strong heat for an hour.

CALCIS HYDRAS, *L.* *Slaked lime.*

TESTS, *Lond.* Soluble without effervescence in hydrochloric acid. The solution does not precipitate with ammonia.

CALCIS AQUA, E. D. CALCIS LIQUOR, L.

PROCESS, *Edin.* Take any convenient quantity of water; pour a little of it over about a twentieth of its weight of lime; when the lime is slaked, add it to the rest of the water in a bottle; agitate well; allow the undissolved matter to subside; pour off the clear liquor when it is wanted, replacing it with more water, and agitating briskly as before.

PROCESS, *Lond.* Take of
Lime half a pound;
Distilled water, twelve pints.
Slake the lime with a little of the water, pour the rest of the water over it, and agitate. Then cover the vessel and put it aside for three hours. Preserve the liquor, with the remaining lime, in well-closed glass bottles, and use the clear liquid when wanted.

PROCESS, *Dub.* Take of
Fresh-burnt Lime, and
Boiling water, of each one part.
Sprinkle the water on the lime in an earthen vessel, which is to be covered while the lime heats and crumbles; pour on thirty parts of cold water, close the vessel, and shake it repeatedly for twenty-four hours. When the undissolved lime has subsided, pour off the clear liquor, and keep it in well-closed bottles.

LINIMENTUM CALCIS, E. D.

PROCESS, *Edin. Dub.* Agitate briskly together equal parts of Lime-water and Linseed-oil.

FOR. NAMES.—*Fren.* Chaux.—*Ital.* Calce.—*Span.* and *Port.* Cal viva.—*Ger.* Kalk.—*Dut.* Ongebluschte kalk.—*Swed.* Bränd kalk.—*Dan.* Kalk.—*Russ.* Genaia izvest.—*Arab.* Ahuk.—*Pers.* Nooreh.—*Tam.* Chunamboo.—*Hind.* Chunna.

LIME in its caustic state has been known from the remotest times. But its true nature was first pointed out by Black in 1755.

Chemical History.—Lime (Quicklime) does not exist in the pure or caustic state in nature. It is always obtained by exposing its carbonate to heat till the carbonic acid is driven off. Calcareous-spar or Carrara marble should be preferred for the purpose, as supplying the purest lime; but for ordinary medicinal uses common chalk, as directed by the London College, is pure enough. If a crucible be used, the material should be reduced to small fragments, and the process is facilitated, if two or three small holes are drilled in the bottom and cover of the crucible, so as to allow a current of air to pass through it. Large masses are burnt readily if in immediate contact with the fuel. After the lime has become cool, it must be transferred immediately into well-closed vessels; otherwise it quickly recovers carbonic acid from the air.

Lime is a grayish-white, brittle, earthy-like substance, of an alkaline, caustic taste, and extremely infusible. It absorbs water with such avidity that it speedily reduces atmospheric air to perfect dryness, and in a confined space will soon remove the whole water from many hydrated bodies. When water is sprinkled over it, immediate absorption takes place, the lime heats, splits in all directions, and crumbles down into a fine, pure-white powder, which is slaked-lime, or the hydrate of lime of the London Pharmacopœia. This substance has an alkaline, astringent, but scarcely caustic taste. Its combined water is expelled by a strong heat. It is soluble in about seven hundred parts of cold water and in about twelve hundred parts at 212°. The solution, which is the Lime-water of the Pharmacopœias, is best made by agitating slaked-lime in a large

bottle with twenty or thirty times its weight of water, allowing the undissolved lime to subside, pouring off the clear liquor when it is required, and replacing it at once with more water so that another supply may be ready for future use. Lime-water is transparent and colourless, of an alkaline, astringent taste, and alkaline in its reaction on turmeric. Like lime itself, the solution quickly attracts carbonic acid from the atmosphere; and acquires a crust of carbonate of lime. The same compound is thrown down immediately when the breath is propelled through lime-water by means of a tube. By evaporating lime-water in the air-pump vacuum, six-sided prismatic crystals of hydrate of lime may be obtained. The acids unite with lime to form neutral salts, among which are some of the most soluble known to chemists, such as the muriate and acetate, as well as some of the most insoluble, such as the phosphate and oxalate. Oxalic acid precipitates lime-water in a state of extreme dilution. Sulphuric acid does not affect it. It forms soap with oils. The *Linimentum calcis* of the Pharmacopœias is a lime-soap with an excess of linseed-oil. This is shown by the effect of long rest; for the mixture separates into a white soap and a supernatant clear oil. Quicklime consists of one equivalent of each of its elements (Ca + O), and therefore of 20.5 parts of calcium and 8 parts of oxygen. Slaked-lime (CaO + Aq) contains one equivalent or 9 parts of water in addition to these.

Adulterations.—The only important adulterations of lime are with carbonate of lime, and with magnesia,—the former derived from imperfect preparation or careless keeping, the latter from a magnesian limestone having been used to obtain the lime. The presence of carbonic acid is shown by muriatic acid causing effervescence as the slaked lime dissolves in it; and this solution will give a white precipitate with ammonia if there be any magnesia.

Actions and Uses.—Lime is a corrosive and irritant; and in the form of lime water it is astringent, antacid, antilithic and alterative.——Quicklime is a rather active corrosive, chiefly owing to its affinity for water, and partly in consequence of its solvent power over the soft animal solids, which however is inconsiderable.—Its irritant power, even in the hydrated state, is shown by the inflammation excited in the conjunctiva by milk of lime introduced into the eye, as well as by some instances of severe or even fatal inflammation arising in the human subject from lime being swallowed in large quantity.—It is a powerful astringent. Animal matters immersed in it undergo corrugation or induration. Sores washed with it show a tendency to diminished secretion and cicatrization; and are often successfully treated in this way. Burns were at one time universally treated, and not without success, by the lime-water liniment, familiarly called Carron oil from the place where it was first used. It is still in high repute with many, but recent burns are better treated by raw cotton and pressure. Lime-water has been of use as an astringent injection in gleet. Diarrhœa, as well as dysentery in the chronic stage, will sometimes yield more readily

to frequent doses of lime-water than to other more powerful astringents.—As an antacid it has been usefully employed in dyspepsia, especially when the bowels are loose; but the alkaline antacids or magnesia are now with justice preferred in most cases. Lime acquired considerable notoriety as a lithontriptic in consequence of its being, as derived from egg-shells, one of the principal ingredients of the famous nostrum of Miss Stephens. It has no power of actually dissolving calculi in the bladder. But it is not without virtue as a corrective of the lithic acid diathesis; for, as Laugier first, and afterwards Chevallier, have shown, the lithate of lime, which is formed when lime-water is freely administered, is a much more soluble substance than either lithic acid or lithate of ammonia, the principal ingredients of lithic gravel. Lime-water is besides useful in lithic gravel simply by correcting the tendency to acidity in the stomach.——Lime-water and other preparations of lime at one time enjoyed some celebrity, which however seems to have been little warranted, as alterative deobstruents in chronic enlargements of the glands, and sores of a strumous character. Some other empirical applications of this remedy may also be mentioned, such as for the cure of worms, in some nervous diseases as an antispasmodic, and as a wash in many diseases of the skin, more especially lepra, psoriasis, and ringworm of the scalp. It is sometimes serviceable, though by no means to be depended on, as an anthelmintic in ascarides, and likewise as a lotion in cutaneous diseases; but the antispasmodic virtues ascribed to it by some continental physicians are questionable.——The best mode of administering lime-water internally is either along with half its volume of milk, or simply without any addition. Its taste is so slight that patients seldom complain of it long. Externally it is used alone as a lotion or injection, or in the form of liniment with linseed-oil.

Its preparations and doses are:—*Calcis aqua*, E. D. *Calcis liquor*, L., unc. ss. ad unc. iv. *Calcis linimentum*, E. D., externally. *Potassa cum calce*, E. L., escharotic. *Infusum sarsaparillæ compositum*, D., see *Sarza.*

CALX CHLORINATA, *E. L.* *Chloride of lime. Hypochlorite of lime.*

TESTS, *Edin.* Pale grayish-white: dry: fifty grains are nearly all soluble in two fluidounces of water, forming a solution of the density 1027; and of which 100 measures, treated with an excess of oxalic acid, give off much chlorine, and if then boiled and allowed to rest twenty-four hours, yield a precipitate which occupies nineteen measures of the liquid.

TESTS, *Lond.* Soluble in muriatic acid, emitting chlorine.

PROCESS, *Lond.* Take of
Hydrate of lime, a pound;
Chlorine, a sufficiency;
Saturate the lime with the chlorine, the lime being spread in a proper vessel, and the chlorine being obtained from Binoxide of manganese and hydrochloric acid gently heated together.

FOR. NAMES.—*Fren.* Hypochlorite de chaux; Chlorite de chaux; Chlorure de chaux.—*Ital.* Cloruro di calce.—*Ger.* Chlorkalk.—*Russ.* Chloristokislaia Izbest.

CHLORIDE OF LIME (Hypochlorite of lime, Chlorite of lime, Oxy-

muriate of lime, Bleaching powder) was first prepared in 1798 by Messrs Tennant and Macintosh of Glasgow.

Chemical History.—It is extensively prepared by the manufacturer for a variety of uses in the arts, and of such excellent quality, that the Edinburgh College have thought it unnecessary to give any formula for its preparation.

On the small scale it is best made by shaking very pure slaked lime loosely into a conical vessel, to the bottom of which is conducted a tube from an apparatus discharging chlorine (see *Chlorinei Aqua*),—and continuing the transmission of gas till the lime is completely saturated. A larger quantity of gas is absorbed when fifteen per cent of water is mingled with the lime, and also when the lime is occasionally stirred. On the large scale it is made by spreading slaked lime, sometimes moistened with fifteen per cent of water, over a succession of trays or shelves in a close chamber constructed generally of siliceous sandstone,—and then transmitting chlorine from leaden alembics, in which it is disengaged by the action of sulphuric acid upon common salt and black oxide of manganese. In four days the lime is completely saturated. The advantage derived from adding a little water to the hydrate of lime was first publicly mentioned by Dr Ure; who found that one hundred parts of dry slaked lime absorb sixty-five of chlorine, but if moistened with fifteen parts of water, absorb seventy-five of the gas, and thus yield a much stronger chloride.——A still stronger preparation is obtained in the humid way by using milk of lime; which must be kept constantly stirred during the absorption of the gas, to prevent the formation of chloride of calcium.

Chloride of lime is a dry, white or pale grayish-white powder, of a weak chlorine odour, and a bitter, astringent, acrid taste. It slowly deliquesces in the air, and, when exposed either in powder or solution, gradually evolves some chlorine, and becomes carbonate of lime and chloride of calcium (muriate of lime). It is soluble, but not entirely in water,—some lime being always left undissolved; but the proportion is small when the article is of superior quality. The strongest solution according to Dr Ure has a density of 1040; but that which is prepared in the moist way with milk of lime has a density of 1060, and contains at least one-half more chlorine. The solution is colourless, or has a very pale yellow colour, and a faint odour of chlorine. If it be heated so high as 110° it is promptly decomposed, with the evolution of chlorine, the separation of lime and its carbonate, and the production of chloride of calcium; but if there be an excess of hydrate of lime in the fluid, the temperature may be raised nearly to 212° without decomposition occurring (Ure). On the addition of an acid to the solution chlorine is evolved with force. Any acid will have this effect more or less, so that even carbonic acid gas will liberate chlorine. Oxalic acid causes disengagement of chlorine and precipitation of oxalate of lime. The acids decompose likewise the dry chloride of

lime, with the evolution of chlorine. The solution bleaches most vegetable colours, and destroys putrid and other disagreeable odours; and these properties are greatly increased by liberating the chlorine with an acid. It preserves animal substances from decay; but it has some corrosive effect both upon them and upon vegetable fibre.

The nature and composition of chloride of lime are still the subject of dispute among chemists. Some conceive it is literally what its ordinary name implies, a compound of chlorine and hydrated oxide of calcium. Others, among whom may be mentioned Berzelius, Thomson, and Balard, consider it to be a mixture of chlorite or hypochlorite of lime, and chloride of calcium, in the proportion (Thomson) of one equivalent of chlorite and three equivalents of chloride. But this theory, which supposes about two-thirds of the powder to be chloride of calcium, seems rather at variance with the fact that it deliquesces slowly. Whatever view be taken of the nature of chloride of lime, there seems a difficulty in arriving at a correct knowledge of its atomic constitution; for chlorine does not appear to exist in it in atomic proportion at all. Dr Thomson indeed says that at Mr Tennant's Chemical Works the lime is now combined with chlorine exactly in the proportion of one equivalent of each. But Dr Ure doubts the possibility of obtaining so great an absorption of chlorine; and he states that the ordinary commercial chloride of lime consists of 45.4 parts of quicklime per cent, 40.31 of chlorine, and 14.28 of water; and that the best he could make by moistening the slaked lime a little consisted of 39.9 quicklime, 39.5 chlorine, and 20.6 water.

Adulterations.—Chloride of lime is often of inferior quality, either because the lime is from the first insufficiently charged with chlorine, or because it has been spoiled by careless preservation. Various methods have been devised for estimating its quality. The most accurate is that of Gay-Lussac, which consists in ascertaining its power of decolorizing a solution of indigo of given strength. Another method, that of Dalton, much in use in the arts, ascertains its relative power in peroxidating the green sulphate of iron. A third more lately suggested by Dr Ure determines its relative power of decomposing ammonia. All the chlorimeters however which are founded upon such principles are too refined for ordinary pharmaceutic use. The London College has not given any tests of the purity of chloride of lime. The Edinburgh College has suggested as tests the density of a solution of given strength, and the amount of oxalate of lime thrown down in a solution by means of oxalic acid. But it is plain that this method of examination will not detect chloride of calcium, one of the most common adulterations. Probably the simplest criterion of quality is the amount of chlorine gas evolved by a strong acid, as proposed some years ago by Dr Ure. The finest chloride which he could prepare gave 51.8 cubic inches of gas from 100 grains. The commercial chlo-

ride contains considerably less, and yields only between 30 and 40 cubic inches.

Actions and Uses.—Chloride of lime is an irritant, astringent, stimulant, and antiseptic.

Its antiseptic properties are shown partly in the preservation of animal matters from decay, partly in the arrestment of putrefaction and the destruction of putrid and fetid effluvia. It undoubtedly possesses the property both of preventing and arresting putrefaction; although in many instances it seems rather to destroy the odour of putrefaction than to stop its progress. No substance in nature, with the exception of the allied compounds, the chlorides of potash and of soda, approaches it in the property of annihilating fetid effluvia, more especially those which arise from the decay of animal matter. This property depends on its power of decomposing sulphuretted-hydrogen, hydrosulphate of ammonia, and ammonia itself; which are the chief fetid gases evolved during animal putrefaction. The practical applications of chloride of lime as an antiseptic are numerous. It is of great service for destroying the fetor of the evacuations of dysentery and other bowel complaints; for which purpose the solution is introduced into the night-stool. In the form of injection, a solution containing about a fiftieth of its weight of chloride is equally useful for correcting the fetor of malignant diseases of the uterus. A wash containing about a hundredth part of chloride not only is one of the best means of diminishing the fetor of the breath in mercurial salivation, mercurio-syphilitic sore throat, aphthae, venereal ulcerations and other sores of the mouth and fauces, but is likewise one of the most effectual remedies for healing the ulcers. In the dissection of dead bodies which have begun to decay, much convenience is derived from occasional ablution of the parts with a strong solution as they are successively exposed. The uses of chloride of lime in such circumstances, as an antiseptic and disinfecting agent, might be advantageously extended, and are indeed almost unlimited. Where the subject of treatment is not the living body, the energy of the solution as a disinfecting agent may be usefully increased by disengaging the chlorine with some acid, such as the sulphuric or muriatic.——Its property of destroying putrid effluvia led to the employment of it, among other disinfecting agents, for destroying also the emanations from those sick of infectious diseases. In recent times doubts have been entertained whether it is possessed of any such power; and more accurate investigations on the subject are still wanted. Experiments upon the infection of such diseases as fever, cholera, and eruptive disorders are liable to many fallacies; and those upon the virus of diseases capable of being communicated by inoculation are contradictory,—the vaccine virus appearing to resist the action of chloride of lime, and the poison of syphilis and rabies being seemingly destroyed or counteracted by it. Upon the whole, actual facts, as well as the analogy of its action on putrid emanations, render the

existence of the property of neutralizing infectious effluvia far from improbable. Chloride of lime is used for the purpose by sprinkling furniture with its solution, steeping clothes in it, and disengaging its chlorine in apartments by means of muriatic or sulphuric acid.

The irritant action of this substance has not been particularly investigated. But from its sensible properties, and the known action of chloride of potash, there can be no doubt that it must be an active irritant poison.——The astringent action of chloride of lime is well illustrated by a variety of important practical uses of it which have been sanctioned by recent experience. It is one of the best applications to indolent and unhealthy ulcers, especially where attended with excessive discharge. Among other kinds of ulcers in which it is thus serviceable may be mentioned particularly those which succeed chilblains. A solution of one part in 120 of water with a little laudanum has been recommended as an injection in the early stage of gonorrhœa (Rousse). Under the head of its astringent action may probably be also arranged its application to the treatment of cutaneous diseases. I have used it in ringworm of the scalp, lepra, psoriasis, and scabies,—in the first three of these, without observing the benefit which might have been expected from the commendations of some authors, — but in scabies with the best effects. It was first proposed for this disease by M. Derheims. I have never had occasion to use any other remedy since. A solution containing between a fortieth and sixtieth of chloride, applied five or six times a-day, or continuously with wet cloths, allays the intense itching in the course of twenty-four hours, and generally accomplishes a cure in eight days. The superiority of this treatment over the filthy method by sulphur-ointment need not be pointed out. I have also found the same lotion useful in most other eruptions attended with itching; which symptom it allays, even where it does not remove the disease. Some have used chloride of lime successfully as a collyrium in chronic ophthalmia. ——As a stimulant and astringent it has been administered internally, more especially in dysentery and continued fever. In dysentery, both given by the mouth and administered in the way of clyster, it has been found serviceable as might be expected from its general properties. Dr Reid used it successfully in the epidemic typhus of Ireland for arresting diarrhœa, and as a stimulant. Dr Pereira confirms his statements; but the same results have not been witnessed in the fever of this city. It should be given for these purposes in the dose of three to five grains dissolved in a wine-glassful of simple water, or with the addition of some aromatic distilled water; and it must be repeated frequently.—For external use as a stimulant astringent it is sometimes used in the form of ointment made with twenty parts of axunge and between one and three parts of chloride.

There are no officinal forms of chloride of lime except the dry powder. Its dose is gr. iii. ad gr. v.

CALOMELAS, *E.* See *Hydrargyri Chloridum.*

CALUMBA, *E. L.* COLOMBAE RADIX, *D.* *Root of Cocculus palmatus, DC.* *Calumba.*

TESTS, *Edin.* Its infusion is precipitated by infusion of galls, rendered blue by iodine, and not altered by sesquichloride of iron.

INFUSUM CALUMBAE, E. L. COLOMBAE, D.

PROCESS, *Edin.* Take of
Calumba, in coarse powder, half an ounce;
Cold water, about a pint.
Triturate the Calumba with a little water so as to moisten it thoroughly; put it into a percolator and transmit cold water till sixteen fluidounces of infusion be obtained.

PROCESS, *Lond. Dub.* Take of
Calumba, sliced, five drachms;
Boiling (distilled, L.) water, one pint.
Macerate for two hours in a loosely covered vessel, and strain.

TINCTURA CALUMBAE, E. L. COLOMBAE, D.

PROCESS, *Edin.* Take of
Calumba, in small fragments (if by percolation, in moderately fine powder) three ounces;
Proof spirit, two pints.
Digest for seven days; pour off the clear liquor, express the residuum strongly, and filter the liquors. This tincture is much more conveniently prepared by the process of percolation, allowing the powder to be soaked with a little of the spirit for six hours before putting it into the percolator.

PROCESS, *Lond. Dub.* Take of
Calumba, three ounces (two ounces and a half, D.);
Proof-spirit, two pints (old measure, D.)
Macerate for fourteen days, and strain.

FOR. NAMES.—*Fren.* Colombo.—*Ital.* Calumba.—*Port.* Raiz de Calumba.—*Ger.* Columbo-wurzel.—*Dut.* Colombo-wortel.—*Swed.* Columborot.—*Dan.* Columbo. —*Russ.* Koren Kolomboe.—*Tam.* Columboo vayr.

FIGURES of Cocculus palmatus in Bot. Mag. 2970, 2971; and as Menispermum palmatum in Asiat. Res. x. 385.—Nees von E. 361.—Hayne, ix. 18.

CALUMBA was first made known in European medicine by Redi, who supposed that it came from Colombo in Ceylon. It was consequently long designated in the Pharmacopœias by the officinal name of Colomba.

Natural History.—Redi however was wrong as to the commercial source of the drug; and little or nothing was ascertained upon this head or regarding its botanical origin, till 1770, when Poivre and Commerson paved the way for the later researches of Lamarc, and the decisive investigations of Dr Berry (Asiat. Researches, x.), by whom it has been fully determined that Calumba is the root of a plant inhabiting the forests near the coast of Mozambique and Oïbo in Eastern Africa. This was first termed by Lamarc *Menispermum palmatum,* but is now generally recognized by Decandolle's name *Cocculus palmatus.* It belongs to the Linnæan class and order *Hexandria Digynia,* and to the natural family *Menispermaceæ* of Decandolle and Lindley. It is a climber, presenting the general character of our indigenous bryony, producing an annual stem, but having a perennial root, which consists of several spindle-shaped tubers between two and four inches in diameter, brown externally, bright yellow in substance, without odour, but intensely bitter. It has been cultivated both at Madras, the Isle of France,

and America. The roots are dug during the dry season in March; and in general the tubers only are removed, without injuring the primary root. The tubers, as they are very fleshy and thick, are cut into slices and dried on cords in the shade. Its native name in this state is Kalumb; whence its officinal designation is derived. The best figure of the plant has been given by Sir W. Hooker in the Botanical Magazine from specimens introduced into the Isle of France by Captain Owen.

Chemical History.—Calumba, as seen in the European market, consists of transverse sections of the root, from half an inch to three inches in diameter, and between a quarter of an inch and one inch in thickness. These sections are composed of a thin outer bark, brown, and generally wrinkled, a thick yellowish-gray inner bark, and a spongy, ligneous internal structure of a lighter grayish-yellow colour. The transverse surfaces are wrinkled, and traversed by a few darker yellow or brownish rays. The powder has a pale greenish-yellow tint, a faint aromatic odour, and a strong bitter taste without the slightest acrimony or astringency. The cortical portion of the root has the most intense bitterness.

Calumba readily imparts its bitterness to water, alcohol and ether. Cold water removes the bitter principle, and boiling water dissolves out also some starch. Hence the officinal *Infusum calumbæ* should be made with cold water, as the Edinburgh College directs, and not in the usual way with boiling water, according to the instructions of the other two Colleges. Cold water thoroughly exhausts the root if used in the way of percolation; and it makes an infusion which keeps longer without becoming mouldy. The officinal *Tinctura calumbæ* made with proof-spirit is best prepared by percolation. A clearer and finer preparation is obtained by using rectified spirit. Sulphuric ether removes chiefly the bitter principle, with some resin. By spontaneous evaporation of the etherial solution crystals are sometimes obtained, which may be rendered colourless by repeated crystallization. They are most intensely bitter, soluble in alcohol, ether, and diluted acids, insoluble in water, neutral, and crystallizable in the form of rhombic prisms. As these crystals are obviously the active principle of the root, they have been named Calumbin. This substance was indicated so long ago as in 1811 by Planche, but was first obtained pure by Wittstock. According to Planche the root also contains a third of its weight of starch and a trace of volatile oil, which is the source of its slight aroma.

Adulterations.—Certain spurious roots are sometimes substituted for it; but they are rarely met with in the English market. Bryony-root, which is occasionally sold for it, is easily known by its disagreeable permanent bitterness united with some acridity. The root of the *Swartzia Fraseri*, which has been imported at times into Liverpool as calumba, and which is known in its native country, the United States, under the name of American Calumba, possesses a pure and agreeable bitter taste like the drug of which it is the

counterfeit. But it may be known by its infusion becoming dark-green with the sesquichloride of iron, and remaining unaffected by tincture of galls; while true calumba is not affected by the iron test, and yields a copious grayish precipitate with galls. I am informed by Dr Philip Maclagan, that in the American shops an inferior variety of true calumba is sometimes sold, which is said to be grown in Illinois. A third counterfeit calumba, which seems to occur only in French and German commerce, and which comes from the Barbary coast, is known by the effects of tincture of iodine and sesquichloride of iron on the infusion. Infusion of calumba is not affected by the latter, but is rendered blue by the former, because it contains starch, and no tannin. But the Barbary imitation of it is not affected by iodine, and becomes black with the iron test, because it contains tannin, and no starch (Guibourt). It is supposed by Winckler and by Buchner to be the root of a species of gentian.

Actions and Uses.—Calumba came into general use in medical practice chiefly in consequence of the commendations of Percival and Gaubius. It is one of our best pure bitter tonics, being entirely free of astringency. It has also been thought by Percival and others to have a calmative and soothing influence; and this is not improbable, because its principle calumbin seems to be a narcotic poison of no mean energy (Buchner). Its chief applications are in affections of the stomach and bowels. In dyspepsia it is an excellent tonic, and as such useful in cases of defective tone and deficient secretion; while as a calmative it is likewise sometimes serviceable in irritability of the stomach, indicated by pain or early vomiting after meals. In both states it is advantageously combined with the alkaline bicarbonates. It is an approved calmative tonic in chronic dysentery and diarrhœa. Like other strong bitters, it occasionally checks intermittent fever and the remittents of hot climates. Its best forms are the simple powder given along with peppermint water or some other simple aromatic, the infusion, and also the tincture. The decoction used by some is a faulty preparation, as it contains much starch. The Berlin Pharmacopœia contains an alcoholic extract, which must be a powerful preparation. An equally good extract however may be made by means of cold water as a solvent; and this would supply a convenient form for administering calumba in the shape of pills.

The doses of its preparations are, *Calumba*, E. L.; *Colombæ radix*, D. gr. xx. ad gr. xl. *Infusum calumbæ*, E. L.; *Infusum colombæ*, D. fl. unc. i. ad fl. unc. ii. *Tinctura calumbæ*, E. L.; *Tinctura colombæ*, D. fl. dr. i. ad fl. dr. ii.

CAMBOGIA (SIAMENSIS), *E.* CAMBOGIA, *L. D. Gum-resin from an unascertained plant inhabiting Siam, probably a species of Hebradendron, Graham, ut infra (Edin.) Gum-resin of Stalagmitis gambogioides, Murray (Lond. Dub.) Gamboge; Siam gamboge.*

TESTS, *Edin.* Fracture somewhat conchoidal, smooth and glistening: a decoction of its powder cooled is not rendered green by tincture of iodine, but merely somewhat tawny.

CAMBOGIA (ZEYLANICA). *E. Gummy-resinous exudation of Hebradendron gambogioides, Graham in Comp. to the Bot. Mag. ii.—Ceylon Gamboge.*

PILULAE CAMBOGIAE, E.

PROCESS, *Edin.* Take of
Gamboge,
East Indian or Barbados aloes, and
Aromatic powder, of each one part;
Castile soap, two parts.
Pulverize the aloes and gamboge separately, mix all the powders, add the soap, and then a sufficiency of syrup: Beat the whole into a proper pill mass.

PILULAE CAMBOGIAE COMPOSITAE, L. D.

PROCESS, *Lond. Dub.* Take of
Gamboge, a drachm;
Aloes (Hepatic, D.), 1½ drachm;
Ginger, half a drachm;
Soap, two drachms.
Reduce the gamboge, aloes, and ginger to powder separately; mix them, and beat them to a mass with the soap (and a little treacle, D.)

FOR. NAMES.—*Fren.* Gomme-gutte.—*Ital.* Gomma gutta.—*Span.* Guta gamba.—*Ger.* Gummiharz; Gummigut.—*Dut.* Gutta gum.—*Swed.* Gummi gutta.—*Dan.* Gummigut.—*Russ.* Gummovoc.—*Arab.* Ossara rewund.—*Tam.* Mukki.

FIGURE of Hebradendron gambogioides in Graham, Comp. to Bot. Mag. ii.

GAMBOGE was introduced into Europe from China in 1603 by a Dutch Admiral, Van Neck, and was first made known to European physicians by Clusius. Its botanical source has long been a subject of doubt and controversy, and is still unsettled.

Natural History.—Bontius in 1658 referred it to a Euphorbiaceous plant which he described under the name of *Esula indica*; and his opinion guided that of pharmacologists for a century. In 1670 Hermans described two trees of Ceylon, as producing gum-resins agreeing closely or entirely with officinal gamboge; and these trees are now known to be two Guttiferous species, the *Garcinia Cambogia*, and *Hebradendron gambogioides*. Little attention however was paid for a long time to the important observations of Hermans; and in 1748 Linnæus embarrassed the subject by confounding together both of the species which that botanist described, though they are not less different from one another in botanical characters than in the nature of their resinous exudation. In 1788 Murray of Göttingen, from the manuscripts and dried specimens of Koenig, established a new genus and species, *Stalagmitis gambogioides*, as the source of one sort of gamboge produced in Ceylon; and from a few meagre facts communicated to Koenig by a Portuguese priest, who had seen gamboge made in Siam, but who was no botanist, Murray farther inferred that the same tree also produced the gamboge of that country. Such is the authority on which all the three British Pharmacopœias prior to that of Edinburgh published in 1839,—and not only these, but likewise almost every other modern Pharmacopœia,—assumed *Stalagmitis gambogiodes* as the source of officinal gamboge. In this reference one or another of two errors, if not both, was committed,—on the one hand, by assuming that the island of Ceylon furnished a part of the gamboge of the shops,—and on the other, by conceding to

Murray, that evidence of the botanical source of Ceylon gamboge constituted also evidence of the source of what comes from Siam. A third error and a more serious one still, was pointed out by my late colleague Dr Graham,—namely, that there is no such plant at all as *Stalagmitis gambogioides*, Murray's description having been taken from a patched specimen in Koenig's collection, composed of two species belonging to distinct Guttiferous genera. From a careful examination of specimens of the true gamboge-tree of Ceylon sent to this country by the lady of Major-General Walker, Dr Graham determined the source of Ceylon gamboge to be a peculiar species, forming one of a new genus; and he termed it *Hebradendron gambogioides*. In favour of this tree being equally the source of Siam gamboge we have hitherto nothing more than presumptive evidence, consisting in the exact correspondence, which, in a late investigation upon the subject, I have proved to exist between both kinds of gamboge in chemical composition and all their leading properties.—In the present state of our knowledge it is not an easy matter to lay down a precise reference for officinal gamboge. The Edinburgh College has probably done right in distinguishing two sorts, although one of them is certainly not at present to be found in European commerce; for the College has in this way been enabled to indicate more precisely than in any other mode the amount of our information on the subject. That Siam gamboge, the only officinal sort, is obtained from "an unknown tree of Siam," cannot be doubted; for no European botanist has hitherto seen either the tree or specimens from it.

The *Hebradendron gambogioides* of Ceylon belongs to the natural family Guttiferæ and to Linnæus' class and order *Monœcia Monadelphia*. Dr Wight and other botanists have doubted whether it constitutes a separate genus, or is distinct from *Garcinia*. It is a fine tree of considerable size, producing a pleasant, saccharine fruit about as big as a cherry. The flowers are unisexual, sessile, and axillary; the calyx membranaceous, persistent, and consisting of four sepals; the corolla four-petaled; the stamina terminated by anthers which open by a circular umbilicated operculum; the fruit a quadrilocular berry crowned with a sessile stigma, and containing one seed in each division. The leaves are opposite, petioled, obovate, coriaceous, smooth, entire, and abruptly subacuminate. The only correct figure yet published is given in the Companion to the Botanical Magazine, ii. 193, from a drawing by Mrs Walker. From this plant gamboge is obtained in Ceylon, either from incisions, or more commonly by paring a large slice from the bark, and scraping off the juice that flows out. It flows in the form of a thick, viscid bright-yellow fluid, which, from a specimen sent to me by Mrs Walker, seems to be a watery emulsion, without any volatile oil. It speedily concretes into dry tears or irregular masses, if left on the tree. The natives who collect it dry it before the sun in shallow bowls. In Siam however gamboge is said to be obtained very dif-

ferently,—by bending down the branches, cutting the leaves across, and collecting the drops that fall from them. This does not appear a very probable account of the method. At all events the exuded juice while soft must be kneaded and squeezed into moulds before it can assume the shape in which it is brought to Europe from Siam.

Roxburgh in his Flora Indica made known another plant, the *Garcinia pictoria* of Mysore, as capable, on the authority of Mr Dyer, of producing a kind of gamboge. From information and specimens communicated to me by Dr Cleghorn, this species is very closely allied to *Hebradendron gambogioides*; and its exudation, which has been called Coorg gamboge, from the district where it is produced, is a true gamboge of fine quality, exactly like superior Ceylon gamboge in external characters, composition, and physiological action. This may prove an important discovery, as the tree abounds in the Ghauts between Mysore and the Malabar coast [Pharmaceutic. Journ. 1846.] It is also probable that the *Garcinia elliptica*, or *Hebradendron ellipticum*, Graham, a native of Burmah, produces a true gamboge.

Other species of the Guttiferæ have likewise been supposed to yield this gum-resin, but erroneously. Through the zeal and kindness of Mrs Walker during her residence a few years ago in Ceylon, I have had an opportunity of examining several of their exudations. The *Garcinia Cambogia*, which was once supposed to be one of the sources of true gamboge, yields a yellow gum-resin not unlike it, but neither emulsive, nor cathartic, nor similar in composition. *Xanthochymus pictorius*, common to Hindostan and Ceylon, is another species, from which a yellowish gum-resin may be obtained; but, like that of *Garcinia Cambogia*, it is not emulsive; and besides, it is translucent and very pale; so that there seems no ground whatever for the confident opinion of some, that this tree may yield a kind of gamboge. *Xanthochymus spicatus*, supposed at Colombo to produce gamboge at the opposite side of the island near Batticaloa, yields a soft, non-emulsive, grayish-yellow gum-resin, not unlike the last substance, and quite different from the true drug. The fruit of *Garcinia Mangostana*, the mangosteen-tree, presents on its rind a bright yellow resinoid encrustation; which too is not emulsive. No exudation I have yet examined but those of *Hebradendron gambogioides* and *Garcinia pictoria* can be successfully used as a pigment, or has proved to possess cathartic properties.

Chemical History.—Four kinds of gamboge are more or less known in this country. One, which is not an article of commerce, so far as Europe is concerned, but is brought to Britain in specimens only, comes from Ceylon, where it is produced from the tree just described. The three others, which come from Siam by way of Singapore, are familiar articles in European commerce, and are known in the English drug-market by the names of Pipe, Lump, and Coarse gamboge. The Siam pipe gamboge, and the gamboge

of Ceylon, being both pure or nearly so, they may be described here; the two others, as they are spurious, will be noticed under the head of the adulterations of gamboge.

PIPE GAMBOGE constitutes an important article of commerce from Singapore to this country. It is so named from its ordinary form, that of hollow cylinders. These are from three-quarters of an inch to two inches in diameter, often doubled, and cohering; and sometimes several pipes are accreted into irregular cakes weighing some pounds; in which however the vestiges of cavities may be seen, although much flattened. The surface of the cylinders is greenish-yellow, and striated, because they are moulded in reeds; and the drug is occasionally imported in the original bamboo canes. Pipe gamboge is very brittle. Its fracture is conchoidal, smooth, brownish-yellow, and glistening. It becomes bright gamboge-yellow when frayed, pulverized, or rubbed with the wet finger. It has scarcely any taste, but soon excites a sense of acridity in the back of the throat. Neither has it any smell; but the fine dust thrown up while it is pulverized produces, in quantities inconceivably minute, profuse flow from the nostrils, with sneezing, but without any pain, unless frequently inhaled. With water it readily forms a smooth emulsion, which continues long complete, and is not easily deprived of its yellow colour by filtration. Rectified spirit readily dissolves the greater part of it, leaving only eight or ten per cent of arabin or soluble gum. Sulphuric ether dissolves about four-fifths of it, leaving gum, and taking up a fine reddish-yellow resin, which may be obtained pure by distilling off the ether and heating the residue to 380° F. The resin is transparent, and of a splendid orange colour, but gamboge-yellow in powder. It imparts a perceptible yellow hue to ten thousand times its weight of spirit or water. It is, like other resins, dissolved and saponified by solution of caustic potash. It possesses energetically the physiological actions of gamboge, and retains them although heated to 400°. Its elementary composition is 40 equivalents of carbon, 23 hydrogen, and 8 oxygen (Johnston). Pipe-gamboge is entirely dissolved by the action, first of ether, and then of water. Its composition, according to two analyses of different samples, is resin 74.2,—71.6; arabin or soluble gum 21.8,—24.0; moisture 4.8 in both instances; = 100.8,—100.4. It contains not a trace of volatile oil.

CEYLON-GAMBOGE is used as a pigment and purgative in Ceylon, but has never been an article of European commerce. It is equally fit with pipe-gamboge for all purposes, medicinal or economical, to which that drug is applied; so that if the Cingalese can be taught to prepare it neatly, it ought to become an article of trade. The specimens sent to me by Mrs Walker are in flattish round masses, eight or nine inches in diameter, moulded in shallow bowls. These masses seem composed of aggregated irregular tears, with cavities which are often lined with a grayish and brownish powdery incrustation. It looks a coarse article; but the individual tears present exactly the characters of pipe-gamboge as described above, and the

impurities are much less considerable than would appear from mere inspection. Its chemical characters are also identical. The resin presents the same intensity of colour, the same tint, the same acridity, and the same power of resisting an elevated temperature. The following is the composition of five different samples I have examined, of which the fifth was picked from the bark to which it was attached when I got it, and the fourth was carefully prepared at my suggestion under Mrs Walker's superintendence, and differs little in external appearance from the finest pipe-gamboge of Siam.

	First.	Second.	Third.	Fourth.	Fifth.
Resin,	68.8	71.5	72.9	74.8	75.5
Arabin,	20.7	18.8	19.4	19.2	19.0
Fibre of wood and bark,	6.8	5.7	4.3	2.2	0.0
Moisture,	1.6	not ascertained.		5.0	not ascert.
	100.9	100.0	100.0	101.2	100.0

A more recent analysis by Buchner, confirmed by myself, shows that what was here considered arabin contains a little brown colouring matter, soluble in water and alcohol, and which is not contained in Siam-gamboge.

Ceylon-gamboge does not contain a trace of volatile oil; and the juice sent in the fluid state from Ceylon by Mrs Walker is equally free of oil, being kept fluid in the form of emulsion by water only through the medium of its own gum.

COORG-GAMBOGE is identical in all its properties with the gamboge of Ceylon. It is an excellent pigment. It consist of 80 per cent of resin, 14 gum, and 5 brown colouring matter.

Adulterations.—The adulterations of gamboge have not hitherto attracted the attention which the subject deserves. A considerable part of the Siam gamboge which is met with in druggists' shops, is adulterated with some amylaceous substance. At least there is contained in many samples a quantity of starch and lignin, which do not exist at all in Pipe-gamboge. Such is the constitution of the two commercial varieties known in the English market by the names of Lump and Coarse gamboge. *Lump* or *Cake* gamboge is usually in irregular masses weighing two or three pounds and upwards. It presents visible fragments of wood. It is less brittle than the pipe variety, vesicular, splintery in fracture, and without lustre; but its other external characters are much the same with those of the finest gamboge, and its powder is undistinguishable in appearance. The composition of two distinct specimens I found to be as follows: resin 64.3,—65; arabin 20.7,—19.7; fecula 6.2,—5.0; lignin 4.4,—6.2; moisture 4.0,—4.2; = 99.6,—100.1. There seems therefore to be in Lump-gambogc about eleven per cent of adulteration with amylaceous lignin, probably in the shape of flour. This adulteration is easily detected in the mass by the external characters just given, and in powder by the effect of tincture of iodine on its cooled decoction. The tincture causes a bright green colour in the emulsion, from intermixture of the blue

iodide of starch with the yellow resin; whereas, if the gamboge be pure, a slight brownness merely is communicated to the proper yellow hue.——*Coarse* gamboge, though usually distinguished from Lump-gamboge by the drug-broker, differs in no respect except in so far as it contains a larger proportion of the same impurities. The external characters of the less impure varieties of Coarse gamboge are much the same with those of the Cake kind; but the more impure samples present a grayish-yellow colour equally in mass, in powder, or in emulsion, and they are much more tough and difficult to pulverize. Two samples I examined contained of resin 61.4,—35.0; arabin 17.2,—14.2; fecula 7.8,—19.0; lignin 7.8,—22.0; moisture 7.2,—10.6; = 101.4,—100.8. The worst specimen therefore contained 41 per cent of impurity and only half the due proportion of its active principle, the resin. Its adulteration is of course to be detected by the same means as that of lump-gamboge.

While mentioning the adulterations of gamboge, it may be well to annex a short account of the characters and composition of the gambogioid juices obtained from the guttiferous trees which have at different times been erroneously supposed to yield true gamboge. Of these I have examined with care two only, the exudations of *Garcinia Cambogia* and *Xanthochymus pictorius*. The former is so soft as to be plastic when heated between the fingers; its colour is pale lemon-yellow; and it is wholly incapable of forming an emulsive paste with the wet finger. It consists of yellowish resin 66, arabin 14, volatile oil 12, woody fibre accidentally present 5, loss probably from moisture 3 = 100. Its colouring resin is ten times less intense in tint than that of true gamboge. The exudation of *Xanthochymus pictorius* has a pale yellowish-green colour and some translucency; it is not at all emulsive; and it consists of 76.5 of yellowish-green resin, 17.6 gum, 5.9 accidental fibre, and probably a little volatile oil. It is plain that neither of these substances has any pretensions to be considered a variety of gamboge.——A full account of the properties and composition of the several sorts of gamboge and gambogioid juices will be found in a paper I communicated to Sir William Hooker's Companion to the Botanical Magazine, ii., and another in the Pharmaceutic Journal for 1846.

Actions and Uses.—Gamboge is a powerful irritant, and as such poisonous, producing, when swallowed in large doses, inflammation of the mucous membrane of the stomach and intestines, and when applied beneath the skin, diffuse inflammation of the cellular tissue. A drachm of its powder has proved fatal internally, and less would almost certainly suffice. In medicine it is chiefly known as a cathartic; but it is also a powerful errhine. It belongs to the denomination of drastic and hydragogue cathartics; for in small doses it produces profuse watery evacuations. Its well known poisonous properties in large doses, and the severe tormina or even hypercatharsis occasionally produced by medicinal doses, have led to its being distrusted singly as a purgative; and this distrust has been

not a little aggravated of late in Britain by the fatal accidents which have arisen from the general employment of a notorious nostrum composed in a great measure of gamboge. But there can be no doubt that it is a safe and excellent cathartic when combined with other drugs of similar action, and that it is very useful by imparting activity and certainty to other less powerful purgatives. The Pharmacopœias have an officinal form of this kind, the *Pilula cambogiæ composita*, in which the concurring purgative is aloes, with the addition of ginger to correct the tendency to tormina. Even when given alone, gamboge is far from being so dangerous and inconvenient a purgative as many imagine. If care be taken to use it in moderation, and to reduce it to a state of fine division by trituration with other comparatively inert hard powders, such as sulphate of potash or cream of tartar, it has always appeared to me a perfectly safe hydragogue, which acts effectually, without occasioning for the most part either particular tormina, or much constitutional exhaustion. It is given as a purgative for general purposes wherever an energetic article of the kind is wanted; but it is more especially used for evacuating the watery accumulations of anasarca and other kinds of dropsy.

Gamboge is one of the substances which Italian practitioners of the Controstimulant school have lately used in large doses for the purpose of obtaining a sedative action. It is said that so much as one drachm has been given at once for subduing inflammation of the intestinal canal. This is a kind of treatment which is not likely to encounter many patrons in British practice.——A curious statement has been made by some continental authors,—that, when gamboge is saponified by potash, it loses its cathartic, and acquires diuretic, properties.——It is best given probably in the form of fine powder with bitartrate of potash; but it may also be administered in the form of emulsion, which may be made without any addition to the water; and it is frequently used with other cathartic substances in the form of pill.——Ceylon-gamboge I have found to be quite identical with pipe-gamboge in its action as a cathartic; and it is equally powerful, perhaps rather more so. The resin of gamboge produces in somewhat less doses precisely the same effects with the crude drug. The gum-resin of *Garcinia Cambogia* has no effect at all in the dose of twelve or fifteen grains; which is about thrice the ordinary dose of officinal gamboge. That of *Xanthochymus spicatus* I have found to be emetic in the dose of seven grains.

The preparations of gamboge and their doses are:—*Pulvis cambogiæ*, gr. ii. ad gr. x.—*Pilula cambogiæ*, E. *Pilula cambogiæ composita*, L. D. gr. x. ad gr. xx.

CAMPHORA, *E. L. D.* *Camphor of Camphora officinarum, Nees von Esenbeck, Laurineæ (Edin.)—Peculiar concretion from Laurus Camphora, L. purified by sublimation (Lond.)—Cam-*

phor of Laurus Camphora, L. and of Dryabalanops Camphora, Colebrooke (Dubl.) Camphor.

TESTS, *Edin.* Its powder evaporates entirely when gently heated.

MISTURA CAMPHORAE, E. L. D.

PROCESS, *Edin.* Take of
Camphor, one scruple;
Sweet almonds, and
Pure sugar, each half an ounce;
Water, one pint.
Steep the almonds in hot water and peel them; rub the camphor and the sugar well together in a mortar; add the almonds; beat the whole into a smooth pulp; add the water gradually with constant stirring; and strain.

PROCESS, *Lond.* Take of
Camphor, one drachm;
Rectified-spirit, ten minims;
Water, one pint.
Rub the camphor with the spirit; then drop in the water gradually, and strain through linen.

PROCESS, *Dub.* Take of
Camphor, one scruple;
Rectified-spirit, ten drops;
Refined-sugar, half an ounce;
Warm water, one pint.
Triturate the camphor with the spirit, then with the sugar; add the water during the trituration, and filter through bibulous paper.

MISTURA CAMPHORAE CUM MAGNESIA, E. D.

PROCESS, *Edin. Dub.* Take of
Camphor, ten (twelve, D.) grains;
Carbonate of magnesia, twenty-five grains (half a drachm, D.);
Water, six fluidounces.
Triturate the camphor and carbonate of magnesia together, adding the water gradually.

LINIMENTUM CAMPHORAE, E. L. OLEUM CAMPHORATUM, D.

PROCESS, *Edin. Lond. Dub.* Take of
Olive-oil, four (eight, D.) fluidounces;
Camphor, one ounce.
Rub them together in a mortar till the camphor be dissolved.

LINIMENTUM CAMPHORAE COMPOSITUM, L. D.

PROCESS, *Lond. Dub.* Take of
Camphor, two ounces and a half;
Liquor ammoniæ, seven fluidounces and a-half;
Spirit of lavender, a pint.
Mix the ammonia with the spirit; distil one pint with a gentle heat from a glass-retort. Dissolve in this the camphor.

TINCTURA CAMPHORAE, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Camphor in small fragments, two ounces and a-half (one, D.—five, L.)
Rectified-spirit, two pints (eight fluidounces, D.)
Dissolve the camphor in the spirit.

TINCT. CAMPHORAE COMP. L. TINCT. OPII CAMPHORATA, E. D. See *Opium.*

ACIDUM ACETICUM CAMPHORATUM, E. D. See *Acidum Aceticum.*

FOR. NAMES.—*Fren.* Camphre.—*Ital.* Canfora —*Span.* Alcanfor.—*Port.* Alcanfor.—*Ger.* Kampher.—*Dut.* Kamfer.—*Swed.* Kamfert.—*Dan.* Campher.—*Russ.* Kamphor.—*Arab.* Kafoor —*Pers.* Kaphoor.—*Tam.* Carpoorum; Soodun.—*Hind.* Kupoor

FIGURES of Camphora officinarum in Hayne, xii. 27,—and as Laurus Camphora in Nees von E. 130.—Roque, 44.—Steph. and Ch. iii. 129.

FIGURES of Dryabalanops Camphora in Asiat. Res. xii. 535—Hayne, xii. 17. Steph. and Ch. iv. 170.

IT is probable that the ancient Greek and Roman physicians were unacquainted with CAMPHOR; but the Arabs made use of it under the name of Kaphur or Kamphur, whence its modern name. It is brought to Europe, partly from Batavia, but chiefly from Canton. There are at least two distinct varieties of it, Common or Laurel Camphor, and Borneo or Malay Camphor.

Natural History.—The plant which produces COMMON CAMPHOR is the *Laurus Camphora* of Linnæus, the *Camphora officinarum* of Caspar Bauhin, Hayne, Nees von Esenbeck (Laurineæ), and of Lindley. It belongs to the Linnæan class and order *Enneandria Monogynia*, and to the Natural family *Lauraceæ*. It is said to be a native of Japan, China, and Cochinchina (Nees von Esenbeck), has been cultivated in various hot climates, and is familiarly known in this and other temperate countries as an ornament of conservatories. It is a graceful evergreen tree, whose wood and leaves emit when bruised an agreeable, camphoraceous odour. Camphor is prepared from it chiefly in the island of Formosa (Reeves, Med. Bot. Trans.) about three hundred miles east from Canton. The wood, which has a mottled red and white colour, is the part used for the purpose. This is said by some to be subjected to the process of dry distillation, by others to be boiled with water; and the camphor which distils over is condensed upon straws placed across the upper part of the alembic. The product of the first distillation is in some measure purified by subliming it before it is exported to Europe. It then constitutes the Raw Camphor of commerce; which undergoes farther purification in this country by being again cautiously sublimed either alone or along with a little quicklime. I have ascertained that the wood of branches half an inch in thickness from a conservatory plant of this country yields by distillation with water about a 500th of its weight of pure camphor.—The root of the cinnamon tree also yields by distillation with water (Marshall) a species of camphor, which, from the examination I have made of it, seems identical with the common variety.

The plant which produces BORNEO CAMPHOR is the *Dryabalanops Camphora* of Colebrooke (Asiat. Researches, xii.) and *D. aromatica* of Gärtner and of Lindley, an inhabitant of Borneo and Sumatra, belonging to the Linnæan class and order *Polyandria Monogynia* and to the Natural family *Guttiferæ* of Decandolle, and *Dipteraceæ* or *Dipterocarpeæ* of Lindley and other botanists. This is a magnificent forest tree, of great size. Camphor is obtained from it, not like common camphor by the process of distillation, but in crystalline masses secreted naturally into cavities in the wood. The tree is incapable of yielding camphor till it has attained a considerable age. At an earlier period it exudes from incisions in the trunk a remarkable liquid of a pale yellowish colour and camphoraceous odour, which is called in this country Liquid Camphor of Borneo, and which I have found to consist of 94 per cent of volatile oil and 6 per cent of resin, without any camphor. It is not till the tree attains the circumference of seven feet that solid camphor is produced by it. Trees even of this size, and upwards, are often cut down without any being found in them; and they yield none, if previously tapped for oil. A single tree yields from eleven to twenty-two pounds avoirdupois. The Dublin College has adopted the *Dryabalanops Camphora* as one of the sources of officinal camphor. But this is a mistake. About a century ago

Borneo camphor seems to have been used in British practice as a substance distinct from common camphor. But for a long time it has entirely ceased to be imported into Europe, except in cabinet specimens, and seldom even for that purpose. The reason is, that the Chinese give one hundred times the price for it which they give for ordinary camphor; and consequently the whole of the article produced in Borneo and Sumatra finds its way to the Chinese market. A few years ago a Chinese cattie of it, or about a pound and a quarter avoirdupois, which was purchased for me at Singapore, cost there seven pounds Sterling, when laurel-camphor was in this country only half-a-crown the pound.

Chemical History.—Common Camphor is usually sold in concavo-convex cakes about three inches thick, and perforated in the middle,—such being the form in which it is condensed in the alembics. It is crystalline in texture, white, translucent and shining, brittle, but somewhat elastic, incapable of being pulverized alone, of a powerful, penetrating, diffusible odour, and of a pungent, bitter, cooling taste. Its density at 60° F. is 989, so that it floats on water;—it slowly evaporates at ordinary temperatures, and in the open air, will at length disappear; but in a roomy bottle, it condenses on the upper part in beautiful crystals, which are octaedres or derived forms. It fuses, according to Gay-Lussac, at 349°, according to Dr Thomson, at 288°. It boils at 400°, and in close vessels distils over unchanged. It takes fire readily when heated in the open air. Though very sparingly soluble in water, it communicates a faint camphoraceous taste and stronger odour. When water is charged with carbonic acid, its solvent power is considerably increased. Prolonged ebullition, which seems to have the same effect, causes in reality some change in the nature and constitution of what is dissolved. The nostrum called Tower's Solution of Camphor is supposed to be prepared in this way. Water is the most common menstruum for the administration of camphor as an internal remedy. The London *Mistura camphoræ* is a simple watery solution; which is consequently so feeble, that it can scarce serve any other purpose than to impart a camphoraceous odour to other drugs which may be mixed with it. But camphor may be largely suspended in water in the form of emulsion by means of various additions, such as sugar, almond emulsion, yolk of egg, and the like; and such are the vehicles usually adopted for the forms of the *Mistura camphoræ*, which are intended to produce the medicinal actions of the drug. Trituration with carbonate of magnesia has also the effect of rendering it more easily suspended in water; and in this way is made the *Mistura camphoræ cum magnesia* of the Dublin and Edinburgh Pharmacopœias. All these mixtures are apt to lose their uniformity on standing; the camphor gradually accumulates and accretes upon the surface, unless prevented by frequent agitation; and in this state they become unfit for medical use. A mixture of one part of tincture of myrrh, three parts

of tincture of camphor, and eight of rectified spirit is perfectly miscible with water. Milk suspends so much as an eighth of its weight of camphor with the aid of trituration; and the camphor is not thrown down on the addition of water. This action of milk, which was first pointed out by Dr Cassels, (Edin. Med. Journ. 1812), furnishes a ready mode of administering it, and one which has not been so much attended to as it deserves to be. Alcohol dissolves nearly its own weight of camphor; rectified spirit somewhat less. The latter is the solvent for the officinal *Tinctura camphoræ*. Rectified spirit also possesses the property of rendering camphor easily pulverizable, and is familiarly used by the druggist for that purpose, by sprinkling a few drops over its surface. Sulphuric ether is a good solvent; and so is the spirit of nitric ether. The latter even renders it considerably soluble in water: two fluidrachms of spirit of nitric ether retain a scruple of camphor permanently in solution in four fluidounces of water, and thus constitute an excellent camphor mixture. The fixed and volatile oils readily dissolve camphor. A solution in olive oil constitutes the camphorated oil of common speech, or *Linimentum camphoræ* of the Pharmacopœias. A hot solution in oils when cooled, or an alcoholic solution on being diluted with water, deposits some of the camphor in beautiful feathery crystals. Resins and fats unite with it in any proportion when they are heated together. The alkalis and their carbonates do not act upon it. The acids dissolve it, but at the same time generally alter its nature. Sulphuric acid converts it chiefly into artificial tannin and charcoal, nitric acid partly into camphoric acid, and partly into an oily substance called oil of camphor. Muriatic acid gas is absorbed by it in the proportion of 144 times its volume; and a colourless liquid results, which on the addition of water parts with the camphor unaltered. Acetic acid dissolves it freely without changing its properties. The acetic solution is an officinal preparation under the name of *Acidum Aceticum Camphoratum*. (See *Acidum Aceticum*.) Camphor, according to the analysis of Dumas, which is most confided in, consists of 78.02 per cent of carbon, 10.39 hydrogen, and 11.59 oxygen, or of ten equivalents of carbon, eight equivalents of hydrogen, and one of oxygen ($C^{10} H^{8} O$.) It is considered a protoxide of camphogen (camphene),—an interesting proximate principle of the nature of a volatile oil, which was discovered by Dumas in oil of turpentine, and which enters as a compound radicle into the constitution of many organic substances from the vegetable world (See *Terebinthinæ Oleum*.)

Borneo camphor is white, opaque, of a foliaceous crystalline texture, analogous in taste to common camphor, and similar also in odour, but somewhat alliaceous. Its density is 1009, so that it sinks in water. It is friable, and may be pulverized without addition. It evaporates in the air more slowly than common camphor; so that in twenty-four days, when a mass of the latter had entirely disap-

peared, a similar mass of the former had lost only an eighth of its weight. At 212° it sublimes in a tube, and condenses in the upper part of the tube in crystals. At 270° its fragments soften and agglutinate; but it does not fuse under 380°; and its boiling point is so high as 440°. Muriatic acid gas transmitted through its powder scarcely causes any alteration. These characters, which I ascertained a few years ago, show important differences between this variety of camphor, and that which is obtained from the Lauraceæ. M. Pelouze afterwards examined it at my request analytically; and found its composition to be ten equivalents of carbon, nine of hydrogen, and one of oxygen ($C^{10} H^{9} O$), or, according to the views taken in France of the relative constitution of its elements, ($C^{20} H^{36} O^{2}$). It has therefore the same composition with Cajuput-oil.——Liquid Borneo camphor is not correctly named; for it has but a feeble camphoraceous odour, and no camphor can be detached from it. A specimen in my possession has a pale yellowish-green colour, a strong odour intermediate between that of camphor and that of turpentine, a bitter terebinthine taste, and a density of 888. When distilled with water, it yields 94 per cent of a colourless, very mobile volatile oil, and six per cent of a fixed substance, not at all camphoraceous in odour, and similar in properties to the resins. A portion of this specimen examined by M. Pelouze, gave results which indicate that it is identical in composition with the pure oil of turpentine, and consists of ten equivalents of carbon and eight of hydrogen ($C^{10} H^{8}$). But it absorbs oxygen with avidity. A straw-yellow fluid, sometimes imported into London from China, under the name of Native Oil of camphor, is different from the Liquid Camphor of Borneo. It has a strong odour of camphor; and deposits crystals of that substance.

Actions and Uses.—Long and extensively as camphor has been used in medicine, more systematic inquiries seem necessary for ascertaining its physiological and therapeutic actions. It is held to be a narcotic and irritant in large doses, and in medicinal doses a sedative, anodyne, antispasmodic, diaphoretic, and anthelmintic.

When taken largely in coarse powder, it commonly occasions pain in the stomach, sickness, and vomiting; and animals die chiefly with symptoms of irritant poisoning. But when in a state of fine division, or when dissolved, large doses excite little else than narcotic symptoms, such as giddiness, staggering, obscurity of vision, confusion of ideas, and delirium,—a state in short which considerably resembles intoxication, is attended with increased frequency of the pulse, and ends in stupor interrupted by occasional convulsions. Although it has not hitherto been known to prove fatal to man, there can be no doubt that these effects might terminate fatally if neglected. There is a singular uncertainty in the dose required to produce this action; for a single scruple has been observed to occasion it characteristically, while on the other hand eight times that quantity has been taken without any particular

violence of effect. During its operation there is commonly increased diaphoresis. The camphor is absorbed in the course of its action; for in man the insensible transpiration and sweat, although not the urine, smell of camphor, and in animals after death the whole tissues have the same odour, even the brain not excepted. In animals killed by it death seems to arise from paralysis of the heart; for if the body be examined immediately afterwards, that organ is found to have lost its contractility, and its left cavities contain florid blood.

While these phenomena would appear to indicate a stimulant action on the circulation and still more on the nervous system, with a secondary depressing effect, the current doctrine refers the therapeutic influence of small doses to a primary sedative operation upon the nervous system. It is held to allay nervous excitement, subdue pain, arrest spasm, and sometimes to induce sleep. At the same time it acts as a gentle diaphoretic and induces a sense of coolness and refreshment; so that where the pulse is excited, especially in connexion with an excited state of the nervous system, depression of the circulation and even also of the animal temperature may ensue. On account of these virtues camphor is used in continued fevers of the typhoid type, especially when nervous symptoms, such as delirium, watchfulness, tremors, and starting of the tendons, prevail in the advanced stage; and by some authors, such as Dr Cullen, its utility in such circumstances has been considered undeniable. It does not accelerate, but on the contrary rather reduces the frequency of the circulation in fever, and removes the jarring beat which often characterizes the pulse. The belief once entertained in the antiputrescent properties of camphor in typhoid fever must be surrendered with the theory of putrescency to which that belief owed its birth. Camphor is held by some to be a useful anodyne and sedative in gout and rheumatism when the violence of reaction in the early stage is over,—and likewise to possess similar virtues in similar circumstances in catarrh, together with an expectorant action. Its applications to diseases of the nervous system are numerous. It has frequently a soothing effect in the nervous irritability which attends some cases of palsy, and also in that which follows delivery. It is a useful calmative and anodyne in neuralgia, painful menstruation, and painful diseases of the urinary organs. It had not long ago considerable reputation as a sedative of the nervous system in mania; but it is now little confided in for that purpose. It is still supposed by many to possess the property of counteracting the tendency of cantharides blisters to act on the kidneys; but this property is very doubtful. Not more probable is the opinion of some, that it counteracts the disagreeable excitant action of opium on some constitutions,—an opinion however which led to the introduction of one of the officinal forms of that drug, the *Tinctura opii camphorata*. It was long believed to promote the eruption of the various febrile exanthematic

diseases; but this doctrine is now abandoned. It has been used as an anthelmintic; in which respect its energy is not to be depended on. Cullen thought it rendered the action of mercurial preparations milder.

Camphor is employed for various purposes externally. When used as a gargle, it sometimes removes toothache. An injection is often serviceable in allaying irritation in the early stage of gonorrhœa. It is an ingredient of most discutient and anodyne embrocations for articular rheumatism, and chronic cynanche tonsillaris, as well as contusions from blows. It is an excellent anodyne application for chilblains, the intense hot itching of which in the early stage is more readily removed by tincture of camphor than by almost any other remedy. It is not a bad stimulant in the form of tincture or fine powder or liniment for indolent ulcers, or for arresting the progress of gangrenous ulceration. Some have also found it efficacious in chronic cutaneous diseases, more especially in scabies. Among its external uses may be lastly mentioned the wearing of it in a bag to repel the secretion of milk,—a property which has been assigned to it by some French authors, but which is probably not more real than the virtue, still ascribed to it by mothers and nurses in this country, of warding off contagious diseases when similarly employed.

Practitioners differ materially from one another as to the doses of camphor they administer. The probability is that, notwithstanding the caution given long ago by Cullen, the quantity prescribed is much too small. The differences are so great as follows:—*Camphora*, gr. i. ad gr. x.—*Mistura camphoræ*, unc. i. ad unc. iii.—*Mistura camphoræ cum magnesia*, E. D., unc. i. ad unc. iii.—*Linimentum camphoræ*, E. L., externally.—*Oleum camphoratum*, D., externally.—*Linimentum camphoræ compositum*, L. D., externally.—*Tinctura camphoræ*, E. L. D., externally.—*Tinctura camphoræ composita*; see *Opium*.—*Linimentum saponis*; see *Sapo*.—*Linimentum opii*; see *Opium*.—*Linimentum ammoniæ compositum*; see *Ammonia*.

CANELLA, *L. D.* CANELLA ALBA, *D.* *Bark of Canella alba* (*Murr. Syst.—W. DC. Spr.*); *Canella.*

For. Names.—*Fren.* Cannelle blanche.—*Ital.* Cannella bianca.—*Span.* Canela blanca.—*Ger.* Weisser Zimmt; Canell.—*Swed.* Hwit canel.—*Dan* Hvid kanel.

Figures of Canella alba in Nees von E. 418.—Hayne, ix. 5.—Steph. and Ch. ii. 66.

Natural History.—Canella, according to Clusius, was introduced into Europe about the commencement of the seventeenth century. It is the bark of the smaller branches of a middle-sixed tree, inhabiting the West-Indian Islands and some parts of the adjacent American continent, which was named by Linnæus *Winterana canella*, and by Murray *Canella alba.* The plant belongs

to Linnæus's class and order, *Dodecandria Monogynia*, and to the natural order *Meliaceae* in Decandolle's arrangement. Lindley considers its place in the Natural arrangement doubtful.

Chemical History.—Every part of the tree is hot and aromatic, but the bark particularly so. Canella is chiefly the bark of its small branches, and constitutes quills about an inch in diameter; but it is also sometimes met with in flat pieces of considerable size. It is from half a line to two lines thick, and is easily known from all other barks by its very pale yellowish-white colour, and its bitterish, acrid, aromatic taste, intermediate between that of pepper and cloves. Its odour is feeble and intermediate between that of cloves and cinnamon. It is often confounded in the shops with Winter's bark, the produce of the *Drimys Winteri*, which it somewhat resembles in taste, though very little in appearance. Still less does it resemble cinnamon or cassia; which, on account of the promiscuous use of the term Cannelle in the French language, are sometimes mistaken for it by French authors.

According to the analysis of Henry it consists chiefly of gum, starch, albumen, lignin, resin, and volatile oil, with various salts, of which oxalate of lime is one. According to Meyer it contains also mannite. Its active ingredient is the volatile oil, which has a powerful aroma and intense acridity. A pound of bark yields rather more than a drachm of oil.

Actions and Uses.—Canella is used in the West Indies and also in Europe for the general purposes of a spice. It is considered an antiscorbutic in America. It is employed in British medical practice, chiefly as a warm stimulant and tonic, for correcting the tendency of other remedies to occasion nausea or tormina; but it may be used alone as a warm tonic in dyspepsia, whether idiopathic or symptomatic. There are no simple preparations of it in any of the British Pharmacopœias. It forms a part of the Edinburgh Tincture and Wine of Gentian, of the Aloetic Wine of London and Dublin, and of the Dublin Aloes-and-Canella Powder.

The dose of the powder is from ten to thirty grains.

CANTHARIS, *L. E. D.* *Cantharis vesicatoria,—the whole fly.* *Cantharides.*

Acetum Cantharidis, E. L.

Process, *Edin.* Take of
Cantharides in powder, three ounces;
Acetic acid, five fluidounces;
Pyroligneous acid (dens. 1034) fifteen fluidounces;
Euphorbium in coarse powder, half an ounce.
Mix the acids, add the powders, macerate for seven days, strain and express strongly, and filter the liquor.

Process, *Lond.* Take of
Cantharides powder, two ounces;
Acetic acid (dens. 1048) a pint.
Macerate for eight days, stirring occasionally. Then express and strain.

Ceratum Cantharidis, L.

Process, *Lond.* Take of
Cantharides in very fine powder, an ounce;
Spermaceti cerate, six ounces.
Add the cantharides to the melted cerate and mix them.

EMPLASTRUM CANTHARIDIS, E. L. D.

PROCESS, *Edin. Dub.* Take of
Cantharides in very fine powder, two (twelve, D.) ounces;
Wax, two (twelve, D.) ounces;
Resin, two (four, D.) ounces;
Suet, two (six, D.) ounces;
(Axunge, six ounces, D.)

PROCESS, *Lond.* Take of
Cantharides, in very fine powder, a pound;
Wax-plaster, a pound and a half.

Edin. Lond. Dub. Melt the fats (and plaster, L.) together, remove from the heat, sprinkle in the cantharides, and stir briskly as the mixture concretes in cooling.

EMPLASTRUM CANTHARIDIS COMPOSITUM, E.

PROCESS, *Edin.* Take of
Venice-turpentine, 4½ ounces;
Burgundy-pitch, and
Cantharides, of each three ounces;
Wax, one ounce;
Verdigris, half an ounce;
White-mustard seed, and
Black-pepper, of each two drachms.

Melt the wax and Burgundy-pitch, add the turpentine, and while the mixture is hot sprinkle into it the remaining articles previously in fine powder and mixed together. Stir the whole briskly as it concretes in cooling.

EMPLASTRUM CALEFACIENS, D.

PROCESS, *Dub.* Take of
Cantharides plaster, one part;
Burgundy-pitch, seven parts.

Melt them with a gentle heat, mix them thoroughly, and make them into a plaster.

TINCTURA CANTHARIDIS, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Cantharides, half an ounce;
Proof-spirit, two pints, (three, old wine measure, D.)

Digest for seven, (fourteen, L.) days, strain, express strongly the residuum, and filter the liquor.

Edin. This tincture may be obtained more conveniently and expeditiously by percolation, provided the cantharides be reduced to coarse powder, and left with a little of the spirit in the state of pulp for twelve hours before the process of percolation is commenced.

UNGUENTUM CANTHARIDIS, E.

PROCESS, *Edin.* Take of
Resinous ointment, seven ounces;
Cantharides in fine powder, an ounce.

Melt the ointment; sprinkle into it the cantharides powder; and stir the mixture briskly as it concretes in cooling.

UNGUENTUM INFUSI CANTHARIDIS, E.

PROCESS, *Edin.* Take of
Cantharides in moderately fine powder,
Resin, and
Wax, of each one ounce;
Venice-turpentine and
Axunge, of each two ounces;
Boiling water, five fluidounces.

Infuse the cantharides in the water for a night, squeeze strongly, filter the liquid, add the axunge and boil till the water is dispersed. Add the wax and resin; and when these have melted remove the vessel from the fire, add the turpentine, and mix the whole thoroughly.

UNGUENTUM CANTHARIDIS, L. D.

PROCESS, *Dub.* Take of
Cantharides in very fine powder, two ounces;
Distilled water, eight fluidounces;
Resin-cerate (ointment of white resin, D.) eight ounces.

Boil the water with the cantharides down to one-half, and strain. Add the ointment to the liquor, and evaporate to the due consistence.

FOR. NAMES.—*Fren.* Cantharides.—*Ital.* Cantaridi.—*Span.* Cantaridas.—*Port.* Cantharidas.—*Ger.* Kantharide; Spanische Fliege.—*Dut.* Spaansche vliegen.—*Swed.* Spanska flugor.—*Dan.* Spanske fluer.—*Russ.* Shpanskaia mucha.

IT is a matter of doubt at what period the blistering fly of modern medicine first came into use. It was neither the Κανθαρις of Hippocrates nor that of Dioscorides; though the former at least evidently possessed analogous properties.

Natural History.—A considerable number of insects inhabiting

the European continent possess acrid properties, and blister the skin to which they are applied; among which may be mentioned the *Mylabris Füsselini*, *Mylabris cichorii*, *Meloë majalis*, *Meloë proscarabæus*, *Meloë violaceus*, *Meloë autumnalis*, *Meloë Fucia*, *Meloë variegatus*, *Meloë scabrosus*, *Coccinella septem-punctata*, and *Coccinella bi-punctata*. In other parts of the world similar properties are possessed by various insects; of which the best known are the *Cantharis vittata* of North America, and the *Meloë trianthemae* and *Cantharis aurata* of India. Many of these may be employed for medicinal purposes. The *Mylabris cichorii* is now extensively used in the East Indian medical service. The only species ever used in Britain is the common Blistering-fly, or Spanish-fly, as it is called in vernacular speech.

This is the *Cantharis vesicatoria* of Latreille, *Meloë vesicatorius* of Linnæus, or *Lytta vesicatoria* and *Cantharis officinalis* of other naturalists. It belongs to the class of Insects and to the order *Coleoptera*, or beetles. It may be distinguished from other analogous insects by presenting two elytra or wing-covers of a shining green colour, two membranous wings, black, jointed antennæ, and a longitudinal furrow along the head and chest. It is a native of the south of Europe, and also of Germany and Russia; and it has been sometimes seen even in the south of England. It is found on the elder, rose, plum, willow, poplar, and elm, but more especially on the privet, lilac, ash, and honeysuckle. In the form of larva it inhabits the earth; and it comes forth in the state of fly in the month of May, at which season it infests in such numbers the trees and shrubs in some promenades in the south of Europe, as to drive away most visitors. It is dangerous to meddle with them in the day-time; but about dawn they are taken while torpid by men protected with masks and gloves, who shake them from the bushes over sheets, and kill them immediately by immersion in vinegar or by exposure to the vapour of vinegar, spirit, or oil of turpentine. They are then quickly dried in the sun, or with artificial heat. Cantharides were once imported into this country from Spain,—whence is derived one of the names by which they are familiarly known; but they are now brought partly from Messina and partly from St Petersburg (Pereira).

Chemical History.—Cantharides are from six to ten lines long, and about a grain and a half in weight. They may be easily known in their entire state by the characters given above. They have a peculiar disagreeable odour, and a faint resinous taste followed by acridity. When thoroughly dried they may be reduced to fine powder, which presents a dirty grayish-brown appearance with numberless shining green particles. They are apt to be attacked and devoured by other insects; and it would appear that their acrid ingredient is devoured along with other parts (Farines). When they undergo putrefaction, the elytra resist the process for a very long time. Hence cantharides-powder may be detected by its green

specks in the human stomach many months, probably even years, after interment. Various means have been suggested for preserving them from decay.* The most effectual method is, after drying and sifting them, to put them without delay, and entire, into well-corked bottles; and it is farther useful to expose them in this state for half an hour to the heat of boiling water. It is said that those killed with turpentine vapour are most easily preserved from insects, and that the best substance to mix with them for the same purpose is carbonate of ammonia. They ought not to be powdered for store.

Cantharides-powder yields its active ingredients to boiling water, acetic acid, alcohol, proof-spirit, ether, and the fixed or volatile oils. Several of these solvents are used for obtaining pharmaceutic preparations. The watery infusion, boiled with fatty and resinous matters till the water is expelled, forms the officinal *Unguentum infusi cantharidis*, E.; *Unguentum cantharidis*, L. D. The uniformity of this preparation is rather difficult to secure. It is better to make a watery extract from the cantharides and to mix this with the other materials, than to mix with them the infusion, according to the College processes, and then evaporate off the water. The mixture must in either case be very briskly stirred while it cools, to incorporate the extract of cantharides thoroughly with the other ingredients.——Acetic acid somewhat diluted has been adopted as a solvent by the London and Edinburgh Colleges for preparing an *Acetum cantharidis*, which contains the active part of the insect in a state of concentration. It is doubtful whether the addition of euphorbium in the Edinburgh formula constitutes any improvement.——Proof-spirit is the menstruum for the officinal *Tinctura cantharidis*, the only preparation now used internally in British practice. It is better made by percolation than by maceration.——Rectified-spirit, a more active solvent than proof-spirit, is employed on the continent for obtaining an extract, which unites better than the watery extract with the materials for making ointments and plasters.—A still better menstruum, however, were it not for its high price in this country, is sulphuric ether; for little is dissolved by it from cantharides except the active ingredient, and consequently ointments and plasters of great energy may be prepared with an etherial extract. The *Sericum vesicans* of the Paris Codex is made in this way.—The fixed oils also dissolve with energy the active part of cantharides, especially when aided by a gentle heat. Hence in making such preparations as the *Ceratum cantharidis*, L.; *Unguentum cantharidis*, E.; *Emplastrum cantharidis*, E. L. D.; and *Emplastrum cantharidis compositum*, E., the result is not a mere mechanical mixture, but in part a chemical solution. The heat indeed is seldom continued long enough to exhaust the cantharides entirely. But it admits of question, whether the contact of the powder with the melted fats ought not on that account to be prolonged, and the exhausted powder even removed after-

wards by filtration. In this way may be obtained preparations of more uniform strength than those at present recognized by the Colleges; and their energy might be increased, if necessary, by heating the filtered fluid with a fresh portion of cantharides and filtering again. A superior cantharides-plaster is now made in this way in Edinburgh. In all operations in which heat is used in preparing cantharides ointments or plasters, the heat ought not to exceed 212°, because the active constituent is volatile. Thierry found that none of the active principle can be obtained from the powder previously heated for some time in a stove. Undue heat is the ordinary cause of the inactivity often complained of in the common blistering plaster. The compound plaster of the Edinburgh College is seldom used and possesses no advantage over the simple plaster.

Cantharides have been several times analyzed. According to the most successful analysis, that of Robiquet, they consist of a bland, green, fluid oil, the source probably of the green colour of the elytra,—a bland concrete oil,—yellow and black colouring matters, also without acridity,—a principle analogous to osmazôme,—lithic and acetic acids,—phosphates of lime and magnesia, constituting the chief part of the skeleton,—and a white crystalline principle, termed Cantharidin, in which the active properties of the insect entirely reside. This principle appears to exist only in the trunk and soft parts of the body; at least the head, antennæ, elytra, wings and legs are inert or nearly so (Farines). It was found by Robiquet also in the *Mylabris cichorii*, and by Lavini and Sobrero in the seven species of *Meloë* mentioned above.——Cantharidin is best obtained by exhausting powder of cantharides with cold rectified spirit by percolation, concentrating the tincture till most of the alcohol is expelled, and leaving the residue long at rest till crystals form. From these the impurities, consisting chiefly of green oil, are in a great measure removed by elutriation with a little cold rectified spirit, which scarcely acts on crystallized cantharidin; and they may be rendered quite pure by redissolving them in boiling rectified spirit, adding animal charcoal, and crystallizing them anew by rest and cooling (Thierry). Pure cantharidin forms small, white, pearly prisms, which are neutral. It fuses at 210°, volatilizes at a somewhat higher heat in acrid crystallizable vapours, and evaporates slowly even at atmospheric temperatures. It is insoluble in water, but becomes soluble through the medium of the yellow colouring matter. It is sparingly soluble in cold alcohol, readily so at the boiling temperature, easily also in cold ether, in fixed and volatile oils, and in alkaline solutions. It is soluble also in acetic acid; though some have incorrectly denied this, and consequently censured the *Acetum cantharidis* as an unchemical preparation. It is composed of 61·68 per cent of carbon, 6·04 hydrogen, and 32·28 oxygen, that is, $C^{10} H^{6} O^{4}$ (Regnault).

Adulterations.—In the entire state cantharides are scarcely sub-

ject to adulteration in this country. In Germany the *Cetonia aurata* of Fabricius, or *Scarabæus auratus* of Linnæus, the golden beetle, is said to be mixed with it; but this insect may be known by its greater proportional breadth and flat belly. The powder is sometimes of inferior quality from being too old. Occasionally too it is adulterated with euphorbium (Pereira),—an injurious admixture, if, as some allege, it increases the pain caused by the common blistering-plaster. This impurity however is not easily detected.

Actions and Uses.—This drug acts in large doses as a narcotic and irritant, and in small doses as a stimulant diuretic, and occasionally an aphrodisiac. Internally, it is in large doses a powerful and dangerous narcotico-acrid poison,—producing directly violent inflammation of the alimentary canal, and indirectly through absorption, on the one hand, severe irritation or inflammation of the urinary organs, attended with strangury, micturition of blood, sometimes suppression of urine, and occasionally excessive priapism, and also on the other hand, headache, delirium, convulsions, and coma. Twenty-four grains of the powder have proved fatal; and an ounce of the tincture has occasioned alarming symptoms. There is no antidote for poisoning with cantharides; but emetics, bloodletting, opiates by the mouth and rectum, emollients, and general antiphlogistic remedies constitute the proper treatment. In small doses it is thought by some to be stomachic, and by others to exert a general tonic action on the genito-urinary organs. These however are doubtful properties. The effects most generally, yet by no means always, produced by it are increased discharge of urine and sweat, and the gradual arrestment of excessive mucous discharges from the genito-urinary mucous membranes. Its power of exciting the venereal appetite has been grossly exaggerated by many writers, as also its tendency to induce miscarriage. Although both properties are the subject of popular belief, it is well to know, that both are precarious effects in all circumstances, and that neither can be produced except by poisonous doses, which bring life into great danger. It is used internally with frequent success in fluor albus and chronic gonorrhœa, and with more doubtful advantage in paralysis of the bladder, incontinence of urine, amenorrhœa, dropsy, and chronic cutaneous eruptions, especially lepra. Although certainly a diuretic, and of late strongly recommended on that account in dropsy by Mérat, its efficacy has appeared to me feeble and uncertain.——The best pharmaceutic form for internal administration is the tincture in frequent small doses, given with any simple emulsive liquid.

Externally, cantharides cause redness, blistering, suppuration, or sloughing, according to the length of contact with the integuments. When applied to the entire skin, it raises a large blister by occasioning the effusion of serous fluid between the true skin and cuticle; and it causes more effusion than any other local irritant except boiling water or steam. A period varying from five

to eighteen hours is required for the purpose. The blistered part commonly heals in a few days without any suppuration; but in some states of the body troublesome ulceration and even sloughing are apt to ensue, as in typhoid fever, or after exanthematic fevers, if the blister be incautiously formed on a part upon which the body constantly rests. I have known death ensue from sloughing of the back induced in this way. On the contrary, in some persons the skin is preternaturally insensible to the action of blisters; so that no effect is produced unless the skin be previously stimulated in some other way. The best resource in such circumstances is a sinapism before the application of the blistering-plaster. In some constitutions the poisonous irritant action of cantharides upon the urinary organs is apt to be produced to a distressing degree along with their operation as an epispastic. This untoward accident cannot be prevented in any way with certainty; but the best method is to give diluent drinks freely during the rising of the blister, and for some hours afterwards; and the best mode of checking it is to give a large opiate by the mouth or in a clyster. The most convenient preparation of cantharides for acting as a rubefacient is the *Emplastrum calefaciens*, D. The usual preparations for producing a blister are the *Emplastrum cantharidis*, E. L. D. or *Emplastrum cantharidis compositum*, E. spread upon leather. Of late however a variety of substitutes have been used, in which the proper materials for a plaster are united with an oleaginous solution, an alcoholic extract, or with pure cantharidin. The advantages of these preparations are, that they may be made of any degree of strength desired, and that, as a very thin stratum is sufficient, they may be applied more easily to parts of the body upon which it is difficult to fix the ordinary plasters. The best of them is that made with nearly pure cantharidin, or with the etherial extract of cantharides, because it may be spread in an exceedingly thin layer upon very fine waxed-cloth or even upon paper. A blistering preparation of this kind is now used both in Edinburgh and Dublin; and a similar form is the *Sericum vesicans* of the Paris Codex made with one part of etherial extract to two parts of wax. The *Acetum cantharidis* has been adopted for the same purpose in the last editions of the London and Edinburgh Pharmacopœias: and it is convenient, as it may be spread in a few seconds over the skin with a bit of sponge, and does not require an irksome bandage to secure it. But it has not appeared to me so certain an epispastic as some have maintained, unless a poultice or hot fomentations be applied when the part becomes red. Blisters are in universal use for a variety of important purposes. Their chief applications are for the removal of pain, as in toothache, tic douloureux, sciatica, and the like,—to effect derivation, as in local inflammations in their chronic form or advanced stage,—to excite languid action of vessels, as in indolent buboes, or dropsical effusion into joints,—to abate general morbid sensibility, as in various affec-

tions of the brain,—to rouse from general defective sensibility, as in typhoid fever,—to remove the cuticle for the endermic application of remedies, or for establishing an issue,—to alter the action of the surface of old ulcers, or of chronic scaly pustular eruptions. Another useful purpose to which cantharides may be applied externally is for stimulating indolent ulcers, or maintaining a constant discharge from an issue. For the latter of these objects the officinal preparations in general use are the *Ceratum* (L.) or *Unguentum* (E.) *cantharidis*, and the *Unguentum infusi cantharidis*, E. D.; the latter of which when well prepared is the better of the two. But a superior form is an ointment made with an alcoholic extract instead of a watery infusion.

The doses of the officinal preparations of cantharides are: *Pulvis cantharidis*, gr. ss. ad gr. ii. Seldom used. *Tinctura cantharidis*, L. E. D. min. x. ad min. xl. The *Emplastrum cantharidis*, L. E. D. *Emplastrum calefaciens*, D. *Emplastrum cantharidis compositum*, E. *Ceratum cantharidis*, L. *Unguentum cantharidis*, E. and *Unguentum infusi cantharidis*, E. D. are for external use.

CAPSICUM, *E. L.* CAPSICUM ANNUUM, *D.* *Fruit of Capsicum annuum, L. W. Spr. (and of other species of Capsicum, Edin.) Capsicum, or Chilly.*

TINCTURA CAPSICI, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of Capsicum, ten drachms, bruised (or if percolation be followed, in moderately fine powder, E.); Proof-spirit, two pints. Digest for seven days (fourteen, L. D.), strain, squeeze the residuum, and filter the liquors.

This tincture is best prepared by percolation, which may be commenced so soon as the capsicum is made into a pulp with a little spirit, E.

FOR. NAMES.—*Fren.* Poivre d'Inde.—*Ital.* Pepe di Guinea; Peperone.—*Span.* Pimentero annua; Pimiento da Indias.—*Port.* Pimentao da India.—*Ger.* Spanische pfeffer.—*Dut.* Spaansche peper. *Swed.* and *Dan.* Spansk peppar.—*Russ.* Perets strutschkovoi.—*Arab.* Felfel-achmar.—*Pers.* Fulfil surkh.—*Tam.* Mollagai.

FIGURES of Capsicum annuum in Nees von E. 190.—Hayne, x. 24.

CAPSICUM has been used as a condiment in Eastern countries from time immemorial, and appears to have been known to the ancient Romans. It is now a familiar spice in Europe, but especially in this country under the names of Chilly, Guinea-pepper, Spanish-pepper, and Cayenne-pepper.

Natural History.—It is the product of one or more species of *Capsicum*, natives of the East and West Indies and of most hot climates throughout the globe, and also prevalently cultivated in greenhouses in Britain on account of the beauty of its fruit. The genus belongs to the Linnæan class and order *Pentandria Monogynia*, and to the Natural order *Solanaceæ*; in which, as respects the general properties of the family, it constitutes a striking anomaly. Cultivation has produced so many varieties of *Capsicum*, that botanists have been at some loss to distinguish its species with preci-

sion. Four species, *Capsicum annuum*, *frutescens*, *baccatum*, and *minimum*,—more generally considered mere varieties of the single species *C. annuum*,—are known all to furnish more or less of the Chillies and Cayenne of the shops. Among these *C. annuum* and *C. frutescens* differ, at least as cultivated here, the former being a herbaceous annual, while the latter is a shrubby plant. They all agree in producing a shining vesicular berry of a greenish, yellowish, cherry-red, or most generally scarlet colour, consisting of a thin, fleshy, inflated, bilocular or trilocular capsule, and many small, flat, kidney-shaped seeds. Of the fruit as used at table there is an infinite number of varieties, differing in form and size. Some, called Bird-pepper, are of an elongated oval form and of the size of a pickle of wheat, or twice or thrice as large. These are produced by *C. frutescens* or *minimum*. Others, called sometimes Cherry or Berry-Capsicums, are globular, and of the size and appearance of a cherry, or lobed and roundish and attaining sometimes the size of a small orange. These again are the produce of *C. baccatum*. The most common of them have the shape of a horn, and are either from one to three inches long, and with the diameter of their base about a fourth part of their length, or long and slender like the spur of a cock. The latter variety is called Cockspur-pepper; the former usually retains the generic term of Chilly or Capsicum; and both are obtained from the subspecies *C. annuum*. Capsicum berries are generally preserved in vinegar for the use of the table; but they have a finer flavour and retain their properties longer if packed in dry salt. When dried and reduced to a moderately fine powder, they constitute the article usually called Cayenne-pepper, which is their officinal form.

Chemical History.—All the varieties of Capsicum have a faint peculiar odour, and a hot acrid taste, which in some, such as the larger berries grown in this country, is feeble, but in others, such as bird-pepper and some kinds of the cherry sort, is so intense that the smallest fragment will excite when chewed an insupportable glow of heat over the whole mouth and throat. The acridity is communicated to hot water, spirit, vinegar, and fixed oils. A tincture prepared with proof spirit is an officinal preparation in the three British Pharmacopœias. An infusion in water is a common extempore preparation in medical practice. The acetous infusion is a form for domestic use as a condiment under the name of chilly-vinegar. An oleaginous solution or mixture, made by macerating successive portions of cayenne pepper in olive oil and expressing the oil after each maceration, is another form in common use in the West Indies, which possesses the properties of the pepper in a most intense degree, and is believed to retain them longer than any other. The source of the acridity of capsicum is an oleaginous substance, discovered in it by Braconnot and termed by him Capsisin. It has an overpowering acrid taste, volatilizes at a moderate elevation of temperature, and disengages so acrid a vapour that

half a grain will cause every person in a large room to sneeze and cough violently.

Actions and Uses.—Capsicum and Cayenne-pepper belong to the class of irritant poisons; and the latter preparation has been known to occasion death. It is entirely destitute of narcotic properties, so far as is known at present. In both respects it constitutes a singular anomaly in the natural order *Solanaceæ*, which are generally powerful narcotics, but feebly or not at all acrid. On account of its irritant action, it is sometimes used as a counter-irritant,—occasionally for producing the effect of a rubefacient on the skin,—more generally as a stimulant gargle in the ulcerated sore-throat of scarlatina or in chronic cynanche tonsillaris. An incipient attack of common sore-throat without fever, in persons predisposed to that affection, may be often checked at once by a cayenne gargle made as strong as the patient can bear it. For these purposes the best preparation is an infusion of a tea-spoonful of cayenne in six fluidounces of boiling-water, or two drachms of the officinal tincture to four or eight ounces of cold water. Internally cayenne and capsicum berries are used in most hot countries as aromatic condiments; and the practice has been transferred to temperate countries, more especially to Britain. Their effect as condiments is more purely local, and less attended with excitement of the circulation, than that of any other peppers; nor does the excessive use of them seem to induce any farther bad result, than the necessity of continuing them, and of increasing their quantity. Cayenne is a good stomachic for preventing the effect of some nauseating remedies upon the stomach. It is a good aromatic stimulant in those forms of dyspepsia which depend on faulty chymification and defective secretion of gastric juice. It has been used successfully for arresting the paroxysm of intermittent fever (Bergius). Others recommend it as a powerful stimulant in advanced typhus.

The doses of Capsicum and its preparations are *Capsicum*, E. L. D. gr. i. ad gr. v. *Tinctura Capsici.* E. L. D. m. xx. ad dr. i.

CARBO ANIMALIS, *E. L.* *Impure animal charcoal obtained commonly from bones (and flesh, L.) Ivory-black.*

CARBO ANIMALIS PURIFICATUS, *E. L.* *Animal charcoal. Purified ivory-black.*

TESTS, *Edin.* When incinerated with its own volume of red oxide of mercury, it is dissipated, leaving only a scanty ash.

TESTS, *Lond.* It does not effervesce with hydrochloric acid; nor does this acid afterwards yield any precipitate with ammonia or its sesquicarbonate.

PROCESS, *Edin.* Take of
Ivory-black, one pound;
Commercial muriatic acid, and
Water, of each twelve fluidounces.
Mix the acid and water; add gradually the ivory-black, stirring occasionally. Digest with a gentle heat for two days, agitating from time to time. Then boil; dilute with two pints of water; collect the undissolved charcoal on a filter of linen or calico, and wash it with water till what passes through scarcely precipi-

tates with solution of carbonate of soda. Heat the charcoal first moderately, and then to redness in a closely covered crucible.

Process, *Lond.* (Proceed as above till digestion has gone on for two days). Put aside the mixture; pour off the supernatant liquid, and wash the charcoal frequently with water, till the water ceases to come away acid; then dry the charcoal.

For. Names.—*Fren.* Charbon animale.—*Ital.* Carbone animale.—*Ger.* Thierische Kohle.—*Russ.* Givotnoi ugol.

Chemical History.—Crude Animal Charcoal may be obtained from any animal substance. That of muscle, horn, and bone is supposed to answer best the several purposes to which this substance is applied in the arts; and since bone yields it most easily, as well as in large quantity, the animal charcoal of the shops is commonly obtained from that source. A fine variety is obtained by burning dried blood. It is prepared from bones by heating them to low redness in covered vessels till they cease to emit any vapour. In this state, it is called Ivory-black, and sometimes bone-black, and although impure, is fit enough for many purposes in the arts, as well as some pharmaceutic processes. It is chiefly employed for decolorizing vegetable infusions; for which end its powder is digested with the fluid, or the fluid is made to filter through it. It acts most energetically when of dull black colour and in fine powder. The decolorizing action takes place in the cold, but is increased by a boiling temperature. After ivory-black has been once used, its property of destroying vegetable colours is lost, but is recovered on its being dried and heated to redness; this may be repeated many times before it altogether loses its qualities.

For certain pharmaceutic purposes, crude animal charcoal will not answer, from its bulk, and still more because, if there be an acid in the fluids brought in contact with it, the impurities of the charcoal may be dissolved and obtain entrance into the substance it is intended to purify. The impurities are phosphate and carbonate of lime, carburet and siliciuret of iron, and sulphurets of iron and calcium. According to Dumas, as prepared from bones, it consists of 88 per cent of calcareous salts, two per cent of carburet of iron with some siliciuret, and only ten per cent of charcoal. But I have generally found the ivory-black of the shops in this country to yield about 20 per cent of charcoal. The purification is accomplished, according to the processes of the Colleges, by digesting ivory-black in tolerably fine powder in diluted muriatic acid, which dissolves or decomposes all the calcareous compounds as well as sulphuret of iron, with the disengagement of much carbonic acid and some sulphuretted-hydrogen. After the residuum has been thoroughly washed with boiling water, it contains only charcoal with a small proportion of carburet and silica. The last step of the process is to dry the charcoal thoroughly, first moderately, and then at a low-red heat· because its decolorising power, for which chiefly it is used in medicine and pharmacy, is destroyed in the previous steps, and is only restored after the action of a pretty strong heat.

Animal charcoal, is a dark brownish-black, rather coarse powder, tasteless and insoluble. When long exposed to the atmosphere, it absorbs moisture and becomes not so active as a decolorizing agent. It takes fire at a low red-heat, and burns, though slowly. When digested, and still more when boiled, with coloured vegetable infusions, it speedily destroys their colour. Some vegetable colours, however, resist its action.

Adulterations.—The only adulteration to which animal charcoal is subject, is with phosphate and carbonate of lime, owing to its having been carelessly prepared. The London College detects these impurities by effervescence with muriatic acid, and the precipitation of phosphate of lime from the solution by ammonia, or carbonate of lime by sesquicarbonate of ammonia. The Edinburgh College recommends incineration as a preferable test of purity. The addition of the red oxide of mercury expedites the process at the expense of the oxygen of the oxide, the metallic mercury at the same time passing off in vapour. Well-prepared charcoal from ivory-black does not leave above a 200th of spongy ash when treated in this way.

Uses.—Animal charcoal is extensively used in preparing the compounds of morphia and quina, as well as strychnia, veratria, and the like. It is undoubtedly a prompt and convenient decolorizing agent, and essential in many processes. But as it certainly absorbs a portion of most of the substances which it is used to purify, [Warrington] it is perhaps better in many cases to have recourse to the more tedious purification by repeated crystallizations. The nature of the decolorizing action is not well understood. It seems on the whole to depend simply on an affinity subsisting between the charcoal and colouring matter.——Animal charcoal was at one time used in medical practice, but is now entirely abandoned. Like vegetable charcoal, it destroys the odour of putrescent animal matter, and with more energy.

CARBO LIGNI, *E. L. D.* *Charcoal.* *Wood-charcoal.*

CATAPLASMA CARBONIS LIGNI, D.

PROCESS, *Dub.* Take any sufficient quantity of charcoal, red hot and just extinguished by pouring dry sand over it, reduce it to very fine powder, and add it to the Simple Cataplasm. See *Linum.*

FOR. NAMES.—*Fren.* Charbon de bois.—*Ital.* Carbone de legna.—*Ger.* Kohle. - *Swed.* Kol.– *Dut.* Houtskool.—*Russ.* Brevesnoi ugol.—*Arab.* Fuhm chobie. —*Pers.* Zegal chobie.—*Tam.* Adapoo currie.

Chemical History.—VARIOUS kinds of CHARCOAL are met with in commerce and the arts, differing in some respects in their properties, but agreeing in so far as they consist chiefly of the element, carbon. The most important are Lamp-black, obtained from the decomposition of fixed oils, coal-tar, and the like,—Coke, prepared by heating coal to redness in close vessels,—Animal Charcoal, which has been treated of under the previous head,—and Wood-charcoal, which is obtained by burning wood in such a way as to

exclude the access of atmospheric air. The harder woods, such as oak and beech, are commonly preferred for making charcoal; but the Parisian Codex recommends the soft woods to be chosen, such as poplar, willow, or fir. Its quality is improved by pulverizing it, working it into a paste with water, and then exposing it for some time to the sun; for in this way any adventitious taste or odour it may possess is removed (Codex Parisiensis).

Vegetable charcoal when pulverized is dark brownish black, and composed of shining particles, tasteless and inodorous, permanent in the air and insoluble. It is easily inflammable, and much more readily consumed than animal charcoal. The product of its combustion is chiefly carbonic acid; and there is left a scanty ash consisting of earthy matters and a little carbonate of potash. It possesses the property of correcting the fetor of putrescent fluids, and of diminishing the colour of vegetable infusions; but in these respects it is much less energetic than animal charcoal. When heated with the compounds of the metals it generally decomposes them by attracting their oxygen; and hence in one shape or another it is much employed in processes of reduction.

Actions and Uses.—Wood-charcoal has at different times been extensively employed in medical practice, both internally and externally. It is difficult however to give a satisfactory account of its actions. As an external agent it is antiseptic. Internally it is held by some to be a febrifuge, antiseptic, cathartic, anthelmintic, and sedative.—Its antiseptic properties are manifested by its destroying fetor, whatsoever may be its source, as in fetid ulcers of the mouth, natural fetor of the breath, caries of the bones, gangrenous sores, and phagedæna; and in some of these affections, such as in gangrenous sores, and mercurial ulceration of the mouth and throat, it seems even to have a tendency to induce healthy action. It has also been considered by some a useful topical application in certain cutaneous diseases, such as scabies, and lepra; and in illustration of its virtues of this nature, a statement has been made that the Paris charcoal-porters are exempt from diseases of the skin. It is probably the best of all dentifrices. It removes encrustations of the teeth, whitens them, and corrects fetor of the mouth; nor is its employment attended with any risk of injury to the teeth, as is the case with most active dentifrice powders.—— On account of its total insolubility in water or acids, charcoal ought to be inert internally, except so far as its physical qualities may be concerned. Nevertheless it has been maintained by some to be a laxative in habitual constipation, a sedative in diarrhœa connected with irritability of the mucous membrane of the intestines or with acrid secretions, a febrifuge in ague, an antiseptic tonic in typhus, an anthelmintic in ascarides, and an antidote for arsenical poisoning. It certainly seems sometimes of service in correcting fetid eructations and flatulence in dyspepsia; and like other fine insoluble powders, it may prove at times beneficial in ascarides. There

can be no doubt too that a small dose of arsenic, such as five grains, may be given without producing any serious effect, if it be previously mixed with a large quantity of finely-powdered charcoal,—probably because the insoluble powder covering all the arsenic prevents it from coming in contact with the membrane. Charcoal will not remove arsenic from its solutions, and is of no use when administered some time after the poison is swallowed. Its supposed actions as a febrifuge, tonic, laxative and sedative are very questionable.

It is given internally in frequent doses of twenty or forty grains; but much larger quantities may be administered. Externally it is either sprinkled over the affected part in the form of fine powder; or, as in mercurial sore throat, it is suspended in water and used as a gargle; or it is mixed up in the form of poultice, as in the treatment of gangrenous ulcers. The Dublin Pharmacopœia contains a formula for a charcoal poultice, which consists of two parts of oatmeal, and one of linseed-cake worked into a pulpy-mass, and then farther thickened with fine charcoal powder.

CARDAMINE, *L. D. Flowers of Cardamine Pratensis, L. W. DC. Spr.*

For. Names.—*Fren.* Cresson des près.—*Ital.* Cardamindo.—*Dan.* Engekasse. —*Ger.* Wiesenkresse.

Figures of Cardamine pratensis in Hayne, v. 30. Engl. Bot. 776.

There is surely no reason for retaining in the Pharmacopœias this little plant, now entirely abandoned in British practice, and certainly destitute of most of the virtues once ascribed to it.

The *Cardamine pratensis*, one of the commonest of our early spring flowers, belongs to the Linnæan class and order *Tetradynamia Siliquosa*, and to the natural family *Cruciferae*. It abounds throughout this country in moist pastures and by the sides of ditches. It produces lilac or white corymbose flowers, which constitute the officinal part. Every organ of the plant has a bitterish pungent taste, analogous to that of other cruciform species, and probably depending on a volatile oil. This property however is lost in drying, although the dried flower is the form in which it used to be employed medicinally.—It was at one time considered diuretic and antispasmodic, and was given in the dose of a drachm and upwards of the dried flowers several times a-day, in the treatment of hysteric affections, chorea, and even epilepsy.

CARDAMOMUM, *E. L. D. Seeds of Amomum Cardamomum, L.* (*Dubl.*) *Seeds of Alpinia Cardamomum, Roxburgh, Cor. Pl.* (*Lond.*) *Fruit of Renealmia Cardamomum Roscoe, Monand. Plants* (*Edin.*) *Cardamoms.*

Tinctura Cardamomi, E. L.

Process, *Edin.* Take of
Cardamom-seeds, bruised, four ounces and a half;
Proof-spirit, two pints.

Digest for seven days, strain, squeeze the residuum, and filter the liquors. This tincture may be better prepared by the process of percolation in the same way with the tincture of Capsicum, the seeds being first ground in a coffee-mill.

PROCESS, *Lond.* Take of
Cardamom, bruised, three ounces and a half;
Proof-spirit, two pints.
Macerate for fourteen days and strain.

TINCTURA CARDAMOMI COMPOSITA, E. L. D.

PROCESS, *Edin. Lond.* Take
Cardamom seeds, bruised, and
Caraway, bruised, of each two drachms and a half;
Cochineal, bruised, a drachm;
Cinnamon, bruised, five drachms;
Raisins, five ounces;
Proof-spirit, two pints.
Digest for seven (fourteen, L.) days, strain, express strongly the residuum and filter the liquors.
This tincture may be also prepared by the method of percolation, if the solid materials be first beat together, moistened with a little spirit, and left thus for twelve hours before being put into the percolator (*Edin.*)

PROCESS, *Dub.* Take
Cardamom-seeds, bruised, and stripped of the capsules, and
Caraway-seeds, bruised, of each two drachms;
Cinnamon, bruised, half an ounce;
Proof-spirit, two (old wine) pints.
Macerate for fourteen days and strain.

FOR. NAMES.—*Fren.* Cardamome.—*Ital.* Cardamomo.—*Span.* and *Port.* Cardamomo menor.—*Ger.* Kleine Cardamomen.—*Dut.* Kardamom.—*Swed.* Cardemumma.—*Dan.* Cardammomer.—*Russ.* Kardamon.—*Arab.* Ebil.—*Pers.* Kakeleh seghar.—*Tam.* Yaydersie.

FIGURES of Amomum Cardamomum figured in Nees von E. 64.—Roxb. Cor. Pl. iii. 227.
Alpinia Cardamomum figured in Nees von E. 66.—Roxb. Cor. Pl. iii. 226.—As Elettaria Cardamomum, White in Lin. Trans. x. 4 and 5.

THE Καρδαμωμον of the Greek physicians, obtained from India through Armenia (Diosc.), was in all probability one of the cardamoms of modern commerce.

Natural History.—The natural history of this spice, long misunderstood, has been of late cleared up by the inquiries of White, Roxburgh, Maton, and Roscoe into its botanical origin, and those of Dr Pereira respecting its commercial varieties and sources. The various kinds of cardamom met with in Europe are all derived from plants belonging to the Linnæan class and order *Monandria Monogynia*, and to the Natural family *Drimyrrhizeae* of Decandolle or *Zingiberaceae* of Lindley. The *Amomum Cardamomum*, L., a native of Java and other neighbouring islands, long supposed to be the source of the true cardamom of the European market, and alone recognized by the Dublin College, yields the round cardamom of druggists, which closely resembles the other in properties, and is often substituted for it in the East. *Amomum angustifolium*, Roxb., a native of Madagascar and Abyssinia, yields the great or Madagascar cardamom, a variety little seen in this country. *Amomum maximum*, Roxb., abounding in Java and the Malayan Archipelago, produces the Java cardamom of the London market, an inferior sort imported thither only for continental commerce (Pereira). The *Amomum repens* of Linnæus,—called *Alpinia Cardamomum* by Roxburgh, by White, referred by Maton to a new genus, *Elettaria*, and finally arranged by Roscoe with the

Linnæan *Renealmia*, is the species recognized under different names by the London and Edinburgh Colleges. It is a native of Malabar, and is extensively cultivated in that part of India for producing the finest varieties of the spice, known by the name of Malabar cardamoms. A variety of the same species also probably yields (Pereira) the inferior sort distinguished in trade as Ceylon Cardamom, from its commercial origin.

The Malabar species, the *Renealmia Cardamomum*, pushes up a herbaceous stem towards nine feet high; and from the base of the stem arise several jointed, branchy, procumbent scapes, from four inches to two feet long, which become covered with clusters of beautiful flowers, and afterwards with oval trivalvular capsules. These constitute in the dry state the cardamoms of the shops. The plant is cultivated for its fruit in many parts of Malabar, but especially in the Wynaad; and the usual method of raising it is to thin out the trees in a jungle, leaving a few for shade, and letting the felled ones lie where they fall. In no long time young cardamom-plants spring up; and in four years they begin to produce a crop. They flower in April and May, and the ripe capsules are gathered in November (White). Cardamoms, as imported into Britain, are longish ovate, bluntly-triangular, leathery, and from a third of an inch to nearly an entire inch in length. Three varieties are distinguished in trade by the quaint names of Shorts, Shortlongs, and Longs, derived from their respective length; and the first of them, believed to come from the Wynaad, is most esteemed. The capsules are filled with closely compressed, rough, trapezoidal seeds, which present various tints of brown, and possess an agreeable camphoraceous odour, and a grateful, warm, aromatic taste. The capsules being inert, they must be removed before the seeds are put to use; but they should not be removed sooner, as the seeds keep better in them.

Chemical History.—Cardamom-seeds yield their aroma to water and spirit, especially to the latter; which accordingly is preferred for their officinal preparations. Two tinctures are in use, the *Tinctura cardamomi*, a simple tincture, and the *Tinctura cardamomi composita*, containing caraway and cinnamon as well as cardamom, together with raisins to sweeten it, and cochineal to give it colour. Both tinctures are best made by percolation. The seeds consist chiefly of lignin, starch, colouring matter, phosphate of lime, 10.4 per cent of fixed oil, and 4.6 of volatile oil (Trommsdorff). The volatile oil, their active constituent, is colourless, and possesses a strong burning taste, which is lost gradually with age; its constitution is C^{10} H^{8}.

Adulterations.—The following are the distinguishing characters of the most important kinds of the inferior cardamoms met with in English trade, as laid down by Dr Pereira. The Round Cardamom, from *Amomum Cardamomum*, is about the size and form of a grape, but formed of three rounded lobes; and it presents at its

peduncular end, its apex, and its grooves, the remains of crowded hairs, with which the whole capsule is originally covered. The Great or Madagascar Cardamom, from *Amomum angustifolium*, is often two inches long and upwards, pointed at the apex, and of the form of the fig reversed. Java Cardamoms, from *Amomum maximum*, are from two-thirds of an inch to an inch and a half long, oval, often curved, and of a grayish weathered appearance; and their seeds are feebly aromatic. Ceylon Cardamoms, from a supposed variety (Pereira) of *Renealmia Cardamomum*, are acute-angled, towards an inch and a half in length, grayish in colour externally, and comparatively narrower than the Malabar kind, which in other respects they resemble considerably in external characters, but to which they are much inferior in aroma. Other sorts met with in continental trade are mentioned by Guibourt.

Actions and Uses.—Cardamom-seeds are among the most grateful of all aromatics, and, like this denomination of substances in general, they are stimulant, tonic, stomachic, and carminative. Though seldom used singly, they are much in request for aromatising other drugs; and the compound tincture, taken alone, is one of the most pleasant and efficacious of all aromatic cordials for general purposes as a carminative and stomachic. Cardamoms form part of eighteen officinal preparations besides their own tinctures, namely, the *Decoctum aloes*, E. L.—*Electuarium* or *Confectio aromaticum*, E. L. D.—*Electuarium opii*, E.—*Extractum colocynthidis compositum*, L. D.—*Infusum menthæ compositum*, D.—*Infusum sennæ cum tamarindis*, D.—*Mistura gentianæ composita*, L.—*Pilulæ gambogiæ*, E.—*Pulvis aromaticus* or *Pulvis cinnamomi compositus*, E. L. D.—*Pulvis aloes compositus*, D.—*Tinctura cinnamomi composita*, E. L.—*Tinctura conii*, E. L. D.—*Tinctura gentianæ composita*, L. D.—*Tinctura quassiæ composita*, E.—*Tinctura rhei*, E.—*Tinctura rhei composita*, D.—*Tinctura sennæ composita*, E. L. D.—*Vinum aloes*, E.

The doses of its chief preparations are: *Pulvis cardamomi*, gr. v. to gr. xx. *Tinctura cardamomi*, E. L. D., fl.dr. i. ad dr. ii. *Tinctura cardamomi composita*, E. L. D., fl.dr. i. ad dr. ii.

CARUI, *E. L.* CARI CARUI SEMINA, *D.* *Fruit* (*Seeds, D.*) *of Carum Carui, L. W. DC. Spr. Caraway.*

AQUA CARUI, L. D.

PROCESS, *Lond.* To be prepared as Aqua Anethi.
PROCESS, *Dub.* Take of
Caraway, bruised, a pound;
Add water enough to prevent empyreuma. Distil a gallon.

OLEUM CARUI, E. L. D.

PROCESS, *Edin. Lond. Dub.* To be prepared according to the general directions for distilling volatile oils. See *Introduction.*

SPIRITUS CARUI, E. L. D.

PROCESS, *Edin.* Take of
Caraway, bruised, half a pound;
Proof-spirit, seven pints;
Macerate for two days in a covered vessel, add a pint and a half of water, and distil off seven pints.

PROCESS, *Lond.* Take of
Caraway, bruised, twenty-two ounces;
Proof-spirit, one gallon;
Water, two pints.
Mix them, and distil one gallon with a gentle heat.

PROCESS, *Dub.* Take of
Caraway-seeds, bruised, one pound;
Proof-spirit, one gallon;
Water, enough to prevent empyreuma.
Macerate for twenty-four hours, and distil a gallon.

FOR. NAMES.—*Fren.* Carvi.—*Ital.* Carvi.—*Span.* Alcaravea.—*Ger.* Kümmel.—*Dut.* Kerwe.—*Swed.* Bröd kummin.—*Dan.* Kummen; Dansk kummen.—*Russ.* Tmin; Timon.

FIGURES of Carum Carui in Nees von E. 276.—Hayne, vii. 19.—Steph. and Ch. i. 59.

Natural History.—CARAWAY is the entire fruit of the *Carum Carui*, a plant which abounds in various parts of Europe, and is cultivated in the gardens of this country. It is an article of the ancient Materia Medica, being considered to have been the Καρος of Dioscorides. The plant belongs to the Linnæan class and order *Pentandria Digynia*, and to the Natural family *Umbelliferæ*. It has a fleshy root, as thick as the thumb and about six inches long, which is edible. The stem is from one to three feet high, and produces many umbels of white or reddish flowers, which are succeeded each by two single-seeded capsules. The structure of the fruit, which constitutes the caraway or caraway-seeds of the shops, is the same as that of the anise and other umbelliferous fruits. (See *Anisum*). It has a strong peculiar odour, and a powerful aromatic bitterish taste. It contains about four per cent of volatile oil, to which it owes its properties. This oil is easily separated by distillation with water; and is officinal together with a distilled water and spirit impregnated with it. It consists mainly of a hydrocarbon $C^{10} H^{8}$, Carvene, and an oxygenated oil Carvacrole, (Schweiger.)

Caraway and its preparations are used, as warm diffusible stimulants and carminatives, for the general purposes of the umbelliferous aromatics, as explained under the head of Anise. It is used in great quantity on the continent for seasoning bread, cheese, and other articles of daily food. The doses of its preparations are; *Carui*, E. L. D. dr. i. ad dr. ii. *Aqua carui*, L. D. fl. unc. ii. ad fl.unc. iv. *Spiritus carui*, E. L. D. fl.dr. i. ad fl.unc. ss. *Oleum carui*, E. L. D. min. iv. ad min. x.

CARYOPHYLLUS, *E. L. D.* *Dried undeveloped flowers of Caryophyllus aromaticus*, L. DC. (*Lond. Edin.*) *of Eugenia caryophyllata*, W. (*Dub.*) *Clove.*

CARYOPHYLLI OLEUM, *E.L.D.* *Volatile oil of the undeveloped flowers of Caryophyllus aromaticus, &c.* *Oil of Cloves.*

INFUSUM CARYOPHYLLI, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Cloves three drachms (one drachm, D.);
Boiling water (distilled, L.) one pint (half a pound by measure, D.)
Infuse for two hours in a covered vessel, and strain.

CARYOPHYLLI OLEUM, E.

PROCESS, *Edin.* To be prepared from cloves, according to the general directions for obtaining volatile oils. See *Introduction.*

FOR. NAMES.—*Fren.* Girofles ; Clous de girofle.—*Ital.* Garofano.—*Span.* Clavos de especia.—*Port.* Cravo da India.—*Ger.* Gewurznelken.—*Dut.* Kruidnagel.—*Swed.* Kryddneglikor.—*Dan.* Nelliker.—*Russ.* Gvosdika.—*Arab.* Kerenful.—*Pers.* Mykhek.—*Tam.* Craumboo.

FIGURES of Caryophyllus aromaticus in Nees von E. 299.—Hayne, x. 38.—Steph. and Ch. ii. 95.

CLOVES appear to have been made use of by the ancient Egyptians (Mérat), but were unknown to the Greek physicians. They have been employed in European Medicine from a very early period in modern times.

Natural History.—They are produced by a tall and beautiful tree, originally a native of the Moluccas, and long confined to a few localities there in consequence of the jealousy with which the Dutch watched over their monopoly in the Spice Islands. After the middle of last century the tree was transplanted to the Mauritius as well as to Cayenne by French naturalists; and from these sources it was afterwards diffused over most parts of the tropics. But though it thrives and is now abundant in various quarters both of the East and West Indies, it is still believed not to produce anywhere cloves of such fine quality as in its native islands. The tree is the *Caryophyllus aromaticus* of Linnæus and most modern botanists, the *Eugenia caryophyllata* of Willdenow,—which belongs to Linnæus's class and order *Polyandria Monogynia,* and to the Natural family *Myrtaceæ* of Decandolle and Lindley. Cloves are the undeveloped flowers of the plant, and consist of a tubular calyx, bearing a roundish bud of unexpanded petals. They are collected in October and November, and dried quickly in the shade to prevent as far as possible the escape of volatile oil. A tree of moderate size and age yields from five to twenty pounds; but an old one of eight feet in diameter will produce so much as half a hundred-weight. The Dutch are said to have supplied commerce at one time with between two and three millions of pounds annually. The quantity imported into Britain in 1829 was 36,000 pounds.

Cloves have generally a dark brownish-black, sometimes a yellowish-brown colour, a somewhat glistening lustre, a rough surface, considerable density, a pleasant, penetrating, peculiar odour, and an aromatic, slightly astringent, burning taste. The finest, from the Moluccas, are plump, heavy and dark, and give out oil when squeezed with the nail. An inferior sort, which is paler, more shrivelled, and less oily when squeezed with the nail, is imported into England from the Mauritius, and into France from Cayenne. The finer sorts are sometimes adulterated with cloves originally genuine, but deprived of oil by distillation with water. These are distinguished by their more shrivelled appearance, by having lost

the bud of the corolla, and by not yielding any oil to the nail; but they possess the proper odour, which they acquire when left for some time in contact with good cloves.

Chemical History.—Cloves impart their chief sensible and medicinal properties to water, alcohol, spirit and ether. The first of these solvents which is used for preparing the officinal *Infusum caryophylli*, forms a clear wine-yellow infusion, possessing the odour and taste of the drug, and the property of yielding a deep blackish-green precipitate with the salts of peroxide of iron. According to the analysis of Bonastre cloves consist of 18 per cent of volatile oil, 13 tannin, 13 gum, 4 extractive matter, 6 resin, 28 lignin, and 18 moisture. The resin may be obtained in the form of acicular crystals from an alcoholic decoction of cloves. These have been considered by some a peculiar principle under the head of Caryophyllin or Eugenin. The tannin resembles catechu-tannin in its relations to chalybeate salts. The volatile oil, the most important ingredient in a medicinal point of view, is obtained by distilling bruised cloves with water. It is the familiar oil of cloves of the shops.

Oil of Cloves is colourless when recent, but slowly becomes brownish. It has a strong peculiar odour, and an aromatic, intensely acrid, burning taste. It sinks in water, its density being between 1055 and 1061. It is sparingly soluble in water, and freely so in alcohol, ether, acetic acid, and the fixed oils. Nitric acid reddens it, and with the aid of heat forms oxalic acid. It is not a simple oil, but consists of two portions; one of which, of the density 918, passes over with watery vapour, when the crude oil is distilled from solution of potash,—while the other, which remains behind in this process, has the high density of 1079, forms regular compounds with the alkalis, earths, and oxides of the common metals, and thus possesses obviously acid qualities [Ettling.] It has been called Eugenic acid. According to the investigations of Dumas the crude oil consists of 20 equivalents of carbon, 12 of hydrogen, and 5 of oxygen. Ettling found the acid oil to consist of 24 of carbon, 15 of hydrogen, and 5 of oxygen; while the light oil appeared to him to be like oil of turpentine a pure hydro-carbon, $C^{10} H^{8}$.

Adulterations.—Some years ago, when oil of cloves was very expensive, it was commonly adulterated; but at present it is much cheaper, and that which occurs in the English market is generally pure. The best criterions of its purity are the intensity of its taste and its high specific gravity.

Actions and Uses.—The action of cloves and their volatile oil is highly stimulating and even irritant. There can be little doubt that either of them, but especially the oil, might occasion irritant poisoning in large doses. Both are used as condiments in cookery. In medical practice they are chiefly employed as aromatic stimulants for correcting the tendency of other remedies to produce

either sickness or griping. They are scarcely ever used alone, except that the oil is sometimes advantageously applied to the hollow of a decayed tooth for arresting toothache,—for which purpose however it has been latterly displaced by creasote. The officinal preparations of which cloves or the oil of cloves forms a part are the *Infusum aurantii compositum*, E. L. D. *Mistura ferri aromatica*, D. *Spiritus lavandulæ compositus*, D. *Vinum opii*, E. L. D. *Confectio aromatica*, L. D. *Electuarium scammonii*, L. D. *Pilulæ colocynthidis compositæ*, D. and *Spiritus ammoniæ aromaticus*, D.

The doses of the simple preparations of cloves are, *Infusum caryophylli*, E. D. L. fl.unc. i. ad fl.unc. iv. *Oleum caryophylli*, E. L. D. min. ii. ad min. viii.

CASCARILLA, E. L. D. *Bark of Croton Cascarilla, L. W. (Lond. Dub.)—probably of Croton Eleuteria (Swartz, Fl. Ind. Occ.—W. Spr.) and possibly of other species of the same genus (Edin.) Cascarilla.*

INFUSUM CASCARILLAE, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of Cascarilla bruised, an ounce and a-half; Boiling water, (distilled L.) one pint (eighteen ounces, D.) Infuse for two hours in a covered vessel, and then strain through linen or calico.

MISTURA CASCARILLAE COMPOSITA, L.

PROCESS, *Lond.* Take of Infusion of Cascarilla, 17 fluidounces; Vinegar of squills, one fluidounce. Compound tincture of camphor, two fluidounces. Mix them.

TINCTURA CASCARILLAE, E. L. D.

PROCESS, *Edin.* Take of Cascarilla in moderately fine powder, five ounces; Proof-spirit, two pints. Proceed by percolation or digestion as directed for tincture of cinchona.

PROCESS, *Lond. Dub.* Take of Cascarilla, bruised, 5 ounces (4, D.); Proof-spirit, two pints (two pounds by measure, D.) Macerate for fourteen days (seven, D.) and strain.

FOR. NAMES.—*Fren.* Cascarille.—*Ital.* Cascariglia.—*Port.* Cascarilha.—*Ger.* Cascarillrinde; Schakarill.—*Swed.* Kaskarill.—*Dan.* Cascarilla.—*Russ.* Kaskarilnaia korka.

FIGURES of Croton Cascarilla in Sloane's Voyage, i. 86,—Of C. Eleuteria in Sloane, ii. 174.—Steph. and Ch. 150.—Nees von E. 139.—Of C. Pseudochina in Nees von E. Suppl. 21.—Of C. micans in Nees von E. Suppl. 23.

THE term CASCARILLA, which in the original Spanish is applied generically to a great number of the smaller kinds of medicinal barks, denotes in English Pharmacy the bark of one or more species of the genus *Croton*.

Natural History.—This genus belongs to the Natural family *Euphorbiaceæ*, and to Linnæus's class and order *Monœcia Monadelphia*. Although cascarilla has been known in European commerce since at least the close of the seventeenth century, its source is still a matter of dispute. That which occurs in English commerce is at present imported chiefly from the Bahamas (Pereira);

but a bark either the same, or very like it, has at various periods been introduced into the markets of England and the continent from Jamaica, Lima, and Vera-cruz. It was long referred to the *Croton Cascarilla* of Linnæus, a species inhabiting Jamaica, St Domingo and other West-Indian islands, and which has been adopted by the London and Dublin Colleges. But the researches of Dr Wright and Dr Woodville, confirmed by Professor Lindley, have shown, that *C. Cascarilla*, Linn. produces either no cascarilla-bark or an inferior sort only, and that the true cascarilla of the English market has long been obtained from the *C. Eleuteria* of Swartz, a native of Jamaica and the Bahamas. Within a few years also it has been proved by Schiede and others, that a variety of bark called in Mexico Quina blanca, and imported into the continent of Europe under the name of Copalchi-bark, differs little in its characters from ordinary cascarilla, and is derived from the *C. Pseudo-China* of Schlechtendal, (*C. Cascarilla* of Professor Don,) a plant inhabiting the Plan del Rio in the province of Vera-Cruz. Farther, Nees von Esenbeck has since rendered it probable that the cascarilla of continental commerce is partly the produce of *C. micans*, a Jamaica species considerably resembling the last. The general result of all these inquiries seems to be that the Edinburgh College is right in referring cascarilla to several species of croton; and that the reference of the two other Colleges is wrong.

Chemical History.—Cascarilla bears a considerable resemblance to the Gray or Huanuco variety of Cinchona-bark, and is said to be sometimes mistaken for it. Its characters however are essentially different when rightly examined. It occurs in shorter pieces, seldom exceeding six or even four inches in length. These are commonly quilled, sometimes almost flat, externally gray, with some portions nearly white and others yellowish-brown, internally brown and for the most part shining. The epidermis is intersected by numerous longitudinal and transverse fissures, but the inner surface is smooth. It is dense, brittle and easily reduced to powder, which has a light brown colour, a feeble aromatic odour increased by heat, and a strong aromatic, bitterish, acrid taste. Water and spirit readily extract its active ingredients, and are therefore used for making the officinal *Infusum* and *Tinctura cascarillæ*. The watery infusion, which has a yellowish-brown colour, is not affected by tincture of galls, and acquires only a somewhat deeper colour with the sesquioxide-salts of iron. By the action of these two reagents, as well as by its acrid and comparatively feeble bitter taste, it is easily distinguished from the true cinchonas. Trommsdorff found it to contain, besides ligneous fibre, 15 per cent of bitter resin, 18.7 of a bitter gummy extract, and 1.6 of a hot volatile oil, of density 993 [Duval.] Brandes subsequently indicated an alkaloid in the variety called Copalchi-bark, which is obtained from the *Croton Pseudo-China*; but his discovery is not generally admitted. What he procured may have been the neutral crystalline

matter, obtained by Duval on evaporating a watery infusion previously decolorized by acetate of lead. From its bitterness this substance, cascarilline, may be inferred to be the active principle of the bark. It resembles salicine in many respects.

Actions and Uses.—Cascarilla is tonic and stimulant in its action. It long enjoyed great reputation as a febrifuge; in which respect it has been considered by some to be not inferior to cinchona, and is still highly esteemed in Mexico, though now out of use as such in European practice. It is chiefly employed as a warm tonic in dyspepsia, chronic diarrhœa, and dysentery, as well as in the debility attending chronic ailments or convalescence from acute diseases. Anthelmintic virtues have also been ascribed to it; and Descourtils says he found it an approved remedy for arresting vomiting. It is a good addition to cinchona in the treatment of intermittent fever, when that drug has a tendency to excite sickness. It evolves a musky odour when burned, and is a common ingredient of fumigating pastilles.

The doses of its preparations are *Cascarilla*, scr. i. to scr. ii.—*Infusum cascarillæ*, fl.unc. i. to fl.unc. iv.—*Tinctura cascarillæ*, fl.dr. i. to fl.dr. iv.

CASSIA SENNA, *D.* See *Senna.*

CASSIAE PULPA, *E. D.* CASSIA, *L.* *Pulp of the pods of Cassia Fistula, L. W. Spr. DC.* *Cassia-pulp.*

CONFECTIO CASSIAE, L. ELECTUARIUM CASSIAE, D.

PROCESS, *Lond. Dub.* Take of
Cassia-pulp, half a pound;
Manna, two ounces;
Tamarind-pulp, an ounce;
Syrup of Roses, eight fluidounces (Syrup of orange, half a pound, D.)
Bruise the manna, dissolve it in the syrup, add the pulps and evaporate to the due consistence (with a slow heat, D.)

FOR. NAMES *Fren.* Casse.—*Ital.* Cassia.—*Span.* Cana fistula.—*Port.* Cana fistula— *Ger.* Röhrcassie.—*Dan.* Cassie.—*Arab.* Khyar shember.—*Pers.* Khyar chember.—*Tam.* Konnekai; sarakonnekai.

FIGURES of Cassia Fistula in Steph. and Ch. iii. 155—Hayne, ix. 39—and as Cathartocarpus Fistula in Nees von E. 314.

THE London College, in its laudable endeavours to simplify pharmaceutic nomenclature, has here inconveniently used the simple term Cassia to denote the officinal part of the *Cassia Fistula*,—a term which is commonly appropriated by druggists to the bark of *Cinnamomum Cassia.* Cassia-pulp has been used in medical practice since the time of the Arabian physicians, by whom it was highly prized.

Natural History.—The plant belongs to the Linnæan class and order *Decandria Monogynia*, and to the Natural family *Leguminosæ.* Along with some other species of the genus *Cassia,* it has been erected into a new genus under the name of *Cathartocarpus*, Necker, Lindley, Nees v. Esenbeck; but many botanists doubt the propriety of this generic distinction.

The *Cassia Fistula* is supposed to have been originally a native of tropical Africa; but it is now extensively diffused over the globe, and is found abundantly in Hindostan, China, the East Indian islands, the West Indies, and South America. It is a fine tree, between thirty and forty feet high, with pinnated leaves, yellow papilionaceous flowers in pendulous crowded clusters, and long blackish, cylindrical pods. The pods as imported into Europe are from nine inches to two feet in length, about the thickness of the thumb, cylindrical, slightly curved, dark brown and shining, or nearly black and dull, and marked with two longitudinal streaks at the sutures of the valves. The capsule is thin, hard, and brittle; its cavity is divided by numerous thin brittle transverse diaphragms; and each partition contains a single, hard, flattened, ovoid seed, surrounded by a soft, black, extract-like pulp. Other occidental species of cathartocarpus, *C. baccillaris*, *C. bicapsularis*, *C. Javanicus*, possess the same medicinal properties (Dr W. Hamilton).

Chemical History.—Cassia-pulp, the only officinal product of the plant, has a sweetish, flat, not unpleasant taste, if of good quality. The druggist usually detaches it by boiling the whole interior of the pod in water, straining the decoction, and evaporating it to the consistence of thick extract, of which there ought to be obtained towards half the weight of the entire pod. The pulp however is said to keep longest when preserved in the pod. It is often of inferior quality. The best pods, which come from the East, are smaller, blacker, and less shining than those imported from the West Indies. They are often quite unfit for use, the seeds being surrounded by a pith-like cellular tissue instead of pulp,—a state which is easily recognized by the rattling of the seeds when the pods are shaken. The pulp ought to be of a black colour, and free of acid odour or mouldiness. It is almost entirely soluble in water; and its active parts are also dissolved by alcohol. It consists, according to the investigations of Henry, of 61 per cent of sugar, 6.75 gum, and 13.25 impure tannin, together with some colouring matter and moisture. A prior analysis by Vauquelin indicates also some gluten and a principle like gelatin, but coincides otherwise with the analysis of Henry. No chemist has yet detected any principle which will account for its laxative properties.

Actions and Uses.—It is a mild purgative, and was long popular in European medicine, but has gradually fallen into such disuse in British practice, that the Edinburgh College no longer admits it into any officinal preparation. Nevertheless it is commended by Dr W. Hamilton, and is said by Mérat to be a mild and effectual laxative even alone in the dose of two or four ounces, and to be particularly adapted for the constipation of old people, as well as the treatment of general fever, colic, inflammatory affections of the bowels, and renal disorders. It is more generally given with other laxatives, such as with tamarind-pulp in the *Electuarium cassiæ* of London and Dublin, and with tamarinds and senna in the Lon-

don *Confectio sennæ*, but it is frequently omitted by druggists in making the latter preparation.

The doses of its preparations are *Cassiæ pulpa*, unc. ii. ad unc. iv. *Electuarium cassiæ*, L. D. dr. i. ad dr. iv. *Confectio Sennae*, L. dr. ss. ad dr. iv.

CASSIAE CORTEX, *E. D.* *Bark of Cinnamomum Cassia, Blume Bijdrag tot de Flora van Nederland. Ind.—Hayne, Darstellung, &c.* xii. (*Edin.*) *Bark of Laurus Cassia, L.* (*Dub.*) *Cassia-bark.*

CASSIAE OLEUM, *E.* *Volatile oil of the Bark of Cinnamomum Cassia (Blume, &c.)* *Oil of cassia.*

AQUA CASSIAE, E.

PROCESS, *Edin.* Take of
Cassia-bark bruised, eighteen ounces;
Water, two gallons;
Rectified-spirit, three fluidounces.
Mix them together, and distil off one gallon.

SPIRITUS CASSIAE, E.

PROCESS, *Edin.* Take of
Cassia-bark in coarse powder, one pound;
proceed as for Spirit of caraway.

TINCTURA CASSIAE, E.

PROCESS, *Edin.* Take of
Cassia-bark in moderately fine powder, three ounces and three drachms;
Proof spirit, two pints.
Digest for seven days, strain, express the residuum strongly, and filter. This tincture is more conveniently made by percolation, the cassia being allowed to macerate for twelve hours in a little of the spirit before being put into the percolator.

FOR. NAMES.—*Fren.* Cassia lignea.—*Ital.* Casilignea.—*Span.* Casialignea; Canela Malabarica.—*Port.* Cassia lenhosa.—*Ger.* Cassienzimmt; Chinesischer zimmt.—*Dut.* Houtcassie.—*Russ.* Lshckoritsa.—*Arab.* Seleekeh.—*Tam.* Lawanga puttay.—*Hind.* Tuj.

FIGURES of Cinnamomum Cassia in Hayne, xii. 23.—as Laurus Cassia in Nees von E. 129.—as Laurus Cinnamomum in Bot. Mag. 2028.

THE London College has not recognized CASSIA-BARK among the articles of the English Materia Medica. But this is an important omission; for the bark and its preparations are kept in every druggist's shop, and are extensively used for the same purposes with cinnamon. It is indeed generally sold even under the same name both for culinary and for medical use; so that in most shops *true* cinnamon is not obtained by the purchaser unless asked for under that designation. Cassia-bark has probably been known as long as cinnamon.

Natural History.—There is scarcely any drug whose commercial or botanical history is involved in such confusion. It would serve no good purpose to enter here into a full discussion of what has been lately written on these subjects, because this would lead to details equally tedious and unproductive of positive conclusions. A short sketch of the question must suffice. From the inquiries of Dr Pereira carried on through means of the custom-house entries at London, it would seem that a bark, called in the drug-trade

Cassia-bark or Cassia lignea, but obviously comprising several sorts of allied barks, is imported into England from Singapore, Malabar, Mauritius, Bombay, Calcutta, Batavia, and Canton. But by much the greater part, and the most characteristic sort,—that which is known among French and German pharmacologists by the name of Chinese cinnamon,—comes from Singapore, and is the produce of China.

Pharmacologists long imagined that the Cassia lignea of European commerce was the bark of the *Laurus Cassia* of Linnæus. But the characters of this Linnæan species are so general as to comprise several species plainly different from one another; and they have even been applied so as to include in the species plants belonging to different genera. Among the rest, the species was long made to comprehend a common plant of Ceylon, which was therefore thought to yield cassia. But this plant was proved by Mr Marshall to produce a totally different bark; and a few years ago I was enabled, with the aid of the lady of Major-General Walker, then residing at Colombo, to refer it to *Litzœa zeylanica* (Nees von E.),—a conclusion which has also been since come to by so eminent an authority as Dr Wight——A very different opinion, that of Mr Marshall, founded on inquiries made while he was staff-surgeon in Ceylon, referred cassia, or at least a part of it, to the true cinnamon tree of that island, of which he maintained it to be the coarser bark from the larger branches. But this doctrine has always appeared to me untenable. For, in the first place, during at least thirty years past nothing has ever been either exported from Colombo, or imported into London from Ceylon, under the name of Cassia; secondly, the very coarsest cinnamons collected at Ceylon, bear in the English market a much higher price than the finest cassias, so that their commercial designation could not be changed without heavy loss; and thirdly, the coarsest qualities of what in English trade is called Third cinnamon, present characters which must prevent them from being confounded by any competent judge with true cassia bark.——The still later botanical researches of Blume, Hayne, Nees von Esenbeck, and Wight, together with the commercial inquiries of Dr Pereira, seem to leave little doubt that in English and Continental trade the name of cassia is given to the bark of more than one species of the natural family *Lauraceæ.* A variety of circumstances render it highly probable that the chief kind of Cassia lignea in English commerce, that which comes from Singapore, is the produce of *Cinnamomum Cassia* of Blume and of Hayne, a plant belonging to the Linnæan class and order *Enneandria Monogynia.* But there is no positive evidence to this effect. Blume's plant, which is the *Cinnamomum aromaticum* of Nees von Esenbeck (Laurineæ) and of Lindley, is cultivated in the stoves of this country; where however, down to the year 1834, the date of my first inquiries on the subject, it was universally confounded with the true cinnamon-tree of Ceylon. From that spe-

cies, however, it is easily distinguished. For in *C. Cassia* the terminal twigs are downy, in the latter, bare, smooth, and shining; the leaves of the cassia-plant are oblongo-lanceolate, and with much less variety in their proportions than those of the cinnamon-tree; the nerves of the cassia-leaf are covered, like the twigs, with fine down, they are never more than three in number, and they unite into a single nerve above the insertion of the leaf-stalk, so that the leaf is rather triplinerved, than trinerved like the cinnamon-leaf, which besides has two subsidiary lateral nerves running up halfway to its extremity; the taste of the cassia-leaf is mucilaginous and cinnamomic, without the slightest clove-flavour always observed in that of the cinnamon; and the calyx of the cassia-flower becomes more fleshy than that of the cinnamon as the fruit advances towards maturity. I have observed these characters on specimens growing at Edinburgh, Glasgow, London and Paris. From information communicated to me by Mr George Loddiges, the eminent nurseryman at Hackney, these have all been derived from plants obtained about forty-five years ago by his father from Canton. There is at present in the Edinburgh Botanic Garden a very fine tree of it, about twenty feet high, which is annually covered with flowers. Dr Neill of Edinburgh has raised the plant from seeds ripened in his conservatory. According to inquiries made at my request by Mrs Walker, this species was quite unknown in Ceylon, either as an indigenous or cultivated, plant so lately as 1836. That the bark of the species cultivated in England is the cassia-bark, which comes to England from Singapore, seems highly probable both from the researches of Blume and of Nees von Esenbeck, and likewise from the close resemblance prevailing between them in taste. It farther seems probable, that other commercial varieties of cassia, differing however from the Chinese kind, are obtained on the Malabar coast and elsewhere, from the transplanted *Cinnamomum zeylanicum* of Blume and Hayne, from the *Cinnamomum zeylanicum*, var. *Cassia* of Nees von Esenbeck, and from other species not so well traced as these.

We are not yet acquainted with the mode of preparing cassia-bark; but from its appearance it probably undergoes the same process with cinnamon, and is always stripped of its epidermis. That which comes from Canton by Singapore is grown in the Chinese province of Kwang-se, whose chief city Kwei-hin (cassia forest) derives its name from being surrounded by great forests of the plant (Reeve). It is imported into this country in bundles between a foot and a-half and two feet long, and from a pound and a-half to twice as much in weight. The importation in 1831 amounted to 818,000 pounds. It is shipped at Canton for about eighty shillings the hundred-weight; and its wholesale price in this country seldom exceeds a shilling the pound. The bundles consist of quills between half an inch and an inch in diameter. These bear a very close resemblance to cinnamon, but may be distinguished by the following

characters. The quills are commonly simple, and very seldom more than double; they are considerably thicker than cinnamon; the outer surface is darker reddish-brown, and the pale threads which traverse it are more distinct and somewhat prominent; the fracture of the inner portion of the bark is sharper and less fibrous; the powder possesses a deeper reddish-brown tint; and the taste and odour, though strongly cinnamomic, are less purely so, the taste being not so sweet, but more pungent, and the fragrance being mingled with an odour which has been likened by many to that of the bug. According to Hayne, the little cavities in the bark which contain its volatile oil present before the microscope seldom two, generally three or more rows of oleaginous cells; while in cinnamon-bark there are never more than two.

Chemical History.—Cassia readily yields its active parts to spirit, but less readily to water. Its watery infusion becomes dark-green and turbid with the sesquioxide-salts of iron. Spirit distilled from it, carries over the whole of its aroma, and thus constitutes the *Spiritus cassiæ* of the druggist. Water in like manner carries over the whole aroma, passes turbid into the receiver, and then slowly separates into a clear, colourless liquid, the *Aqua cassiæ* of Pharmacy, and a volatile oil which partly sinks and partly floats in water, and which is the Oil of cassia of commerce, and *Oleum cassiæ* of the Edinburgh Pharmacopœia. All three preparations are prevalently used instead of the corresponding preparations of cinnamon, but may be distinguished by their inferior sweetness and much greater pungency. According to the analysis of Bucholz, the bark consists of 14.5 per cent of mucilaginous extract, 4 of resin, and 0.8 of volatile oil, with a little bassorine and much ligneous fibre. It must also contain a little tannin.

The Oil of Cassia of the shops is imported from Singapore. It is seldom free of adulteration. The pure oil has a pale wine-yellow colour, which does not deepen with age; its density is so high as 1095 (Geiger), so that it sinks in water; and it possesses intensely the odour as well as taste of the bark. Its chemical relations, which were first carefully examined in 1834 by MM. Dumas and Peligot, are interesting. It promptly absorbs oxygen gas, especially if moist; and acicular or scaly crystals are formed, which are a peculiar acid called Cinnamonic acid. This is entirely volatilizable at 560° F, sparingly soluble in water, more soluble in alcohol, and convertible by nitric acid and heat into benzoic acid, with the disengagement of the odour of bitter-almond-oil. It constitutes the crystals sometimes seen in old specimens of the oil. Concentrated nitric acid suddenly converts the oil into a mass of scaly crystals, forming a compound in which the oil plays the part of a base in relation to the acid. The mass becomes again fluid and oily immediately on the addition of water, and slowly under simple exposure to the air. On the other hand, ammoniacal gas is freely absorbed by the oil, and there is formed a dry, pulverizable, and crys-

tallizable substance, where the oil seems to play the part of an acid. The researches of Dumas and Peligot show that the oil of cassia bears a close analogy in composition and atomic relations to the oil of bitter almonds. It appears to contain a compound radicle, named by them Cinnamyl, which consists of 36 equivalents of carbon, 14 of hydrogen, and 2 of oxygen (C^{36} H^{14} O^{2}); and this radicle unites with two equivalents of hydrogen to form oil of cassia (C^{36} H^{16} O^{2}), and with one of oxygen to constitute cinnamonic acid (C^{36} H^{14} O^{3}).——The ordinary oil of the shops has often a reddish-brown hue and a heavier odour than the pure oil; and when treated with nitric acid, it crystallizes only in part, and not for many hours. I have a commercial specimen, however, which becomes a solid mass of crystals with nitric acid.——Oil of cassia is commonly sold for the purposes of the cook and the confectioner under the name of oil of cinnamon. Its wholesale price at present is about ten shillings the pound.

Closely allied to cassia-bark in properties is the familiar spice called CASSIA-BUDS. This article is not admitted into any of the British Pharmacopœias, and consequently does not here require detailed notice. It consists of the calyx, surrounding and nearly enclosing the young germen. It is imported by way of Singapore, probably from China. Its botanical source is not precisely known. Dr Lindley speaks of flowers of cassia as being yielded by *C. Loureirii*, Nees. But the cassia buds of the shops are most probably produced by the same plant which furnishes cassia-bark; first because both drugs possess the same pungency of taste, and secondly because the *Cinnamomum Cassia* cultivated in the stoves of this country, produces a flower-bud, which at the same period of advancement with the commercial cassia-bud, appears to bear a close resemblance to it. At all events cassia-buds cannot be obtained, as Mr Marshall supposes, from the true cinnamon tree of Ceylon; because the flower-bud of that species at the same stage is very different in appearance, the calyx being not so fleshy, much more deeply cleft, and less turned in at the edge over the germen; its taste too is by no means the same.

Actions and Uses.—Cassia-bark and oil of cassia are powerfully stimulant in their action. In their subordinate properties and practical use in relation to the animal economy, they coincide entirely with cinnamon-bark and its volatile oil; for which, as already observed, they are very generally substituted in the shops on account of their comparative cheapness. There is no reason for depreciating them, as many have done. For when of good quality, their aroma is rich and agreeable; and their medicinal virtues are not inferior to those of the productions of the cinnamon-tree.

The doses of their preparations are *Cassiæ cortex*, E. *Lauri cassiæ cortex*, D. gr. x. ad gr. xxx. *Spiritus cassiæ*, E. fl.dr. ss. ad fl.dr. i. *Aqua cassiæ*, E. fl.unc. i. ad fl.unc. ii. *Tinctura*

cassiæ, E. fl.dr. i. ad fl.dr. ii. *Oleum cassiæ* E. min. ii. ad min. v.

CASTOREUM, *L. E. D.* *A peculiar secretion* (*concretion, L.*) *from the præputial follicles of Castor fiber.* *Castor.*

TINCTURA CASTOREI.

PROCESS, *Edin. Lond.* Take of
Castor, bruised, two ounces and a half;
Rectified spirit, two pints.
Macerate for 14 days, and strain, *Lond.*
To be prepared by the process either of percolation or digestion, like tincture of Cassia, *Edin.*

PROCESS, *Dub.* Take of
Russian castor in powder, two ounces;
Proof-spirit, two pints (old wine measure).
Macerate for seven days and strain.

TINCTURA CASTOREI COMPOSITA, E.

PROCESS, *Edin.* Take of
Castor bruised, two ounces and a half;
Assafœtida, in small fragments, ten drachms;
Spirit of ammonia, two pints.
Digest for seven days in a well closed vessel; strain and express strongly the residuum, and filter the liquor. This tincture cannot be so conveniently prepared by the method of percolation.

FOR. NAMES.—*Fren.* Castoreum.—*Ital.* Castorio.—*Span.* Castoreos.—*Port.* Castoreo.—*Ger.* Bibergeil.—*Dut.* Bevergeil; Beverzwijn.—*Swed.* Bäfwergäll.—*Dan.* Bavergeel.—*Russ.* Bobrovaia struia.—*Arab.* Asch-butchegan.—*Pers.* Goondbeyduster.

CASTOR was the ὀρχις του καστορος of Dioscorides, and was long considered to be the testicle of the beaver. It is now known to be the membrane and contained secretion of certain follicles, two in number, connected with the external genital organs of this animal, the *Castor Fiber* of naturalists.

Natural History.—The Beaver is an inhabitant of Northern Russia and of the northern parts of North America. Some conceive the species to be distinct in the two localities. Almost every part of its body was once held in estimation in medicine, but at present the only medicinal substance produced by it is the drug called castor; and even this is so little used that it seems unnecessary to say much on the subject here.

Both the male and female beaver are provided with follicles, but those of the male are best known. They are filled with a thick fluid secretion, which slowly concretes after they are removed from the animal. The follicles, frequently united by a part of the præputial membrane, and containing their concreted secretion, form the castor of the shops. This is now all derived from North America, the castor of Russia being so very rare in Britain as to be never seen in commerce. American castor has much the appearance of a pair of dried testicles united by their spermatic chords. It is dark liver-brown and wrinkled externally, paler liver-brown internally, resinous in its fracture, of a strong, peculiar, heavy odour, and of an aromatic, bitter, offensive taste. Its sensible properties are communicated better to rectified spirit than to any other common solvent. The composition of the concrete secretion, which forms the internal substance or true castor, is very complex. It contains numerous salts, mucus, a horny matter, osmazome, albu-

men, resinoid matter, volatile oil, carbonate of lime, and a peculiar, crystalline, non-saponifiable substance called Castorin (Brandes.) The carbonate of lime varies in amount from 2.6 Brandes to 40 (Müller) per cent, and in no respect furnishes a criterion, as has been supposed, of the drug being Russian or American.

Actions and Uses.— Castor was long esteemed a powerful stimulant of the nervous system, an antispasmodic, and an emmenagogue. It was consequently used in the treatment of many diseases. Alexander towards the close of last century, and in recent times Professor Jörg, ascertained that even in the dose of two drachms it produces no other effect than troublesome eructations; so that there seems scarcely a possibility that it can act as an antispasmodic. Some however still use it in the slighter forms of hysteria; in which it may be serviceable through means of its nauseous taste.

The doses usually given are *Tinctura castorei*, fl. dr. i. ad fl. dr. ii.—*Tinctura castorei composita*, fl. dr. i. ad fl. dr. ii. The latter owes its properties to assafœtida and ammonia much more than to castor. The former is a very weak preparation.

CATECHU. *Extract of the wood of Acacia Catechu* (*Lond. Dub.*) —*Extract of the wood of Acacia Catechu, W. DC. Spr.—Of the kernels of Areca Catechu, L. W. Spr.—and of the leaves of Uncaria Gambir, Roxb. Fl. Ind. DC.—probably too from other plants; Catechu.* (*Edin.*)

Tests, *Edin.* The finest qualities yield to sulphuric ether 53, and the lowest qualities 23 per cent of tannin dried at 280°

Infusum Catechu, E.—Inf. Cat. Compositum, L. D.

Process, *Edin.* Take of
Catechu, powdered, six drachms;
Cinnamon, powdered, a drachm;
Syrup, three fluidounces;
Boiling water, seventeen fluidounces;
Infuse the catechu and cinnamon with the water for two hours, strain through linen or calico, and add the syrup.

Process, *Lond.* Take of
Catechu, powdered, six drachms;
Cinnamon, bruised, a drachm;
Boiling distilled water, one pint;
Infuse for an hour in a lightly covered vessel and strain.

Process, *Dub.* Take of
Catechu, two drachms and a half;
Cinnamon, bruised, half a drachm;
Boiling water, half a pound.
Digest for an hour in a covered vessel, and strain through linen.

Electuarium Catechu, E.—Elect. Cat. Compositum, D.

Process, *Edin. Dub.* Take of
Catechu, four ounces;
Kino, four (three, D.) ounces;
Cinnamon, one (two, D.) ounce;
(Nutmeg, an ounce, E.)
Opium diffused in a little sherry, a drachm and a half;
Syrup of ginger reduced to the consistence of honey, a pint and a half (two pounds and a quarter, D.)
Pulverise the solids; mix the opium and syrup; add the powder, and beat them thoroughly into a uniform mass.

Tinctura Catechu.

Process, *Edin.* Take of
Catechu, in moderately fine powder, three ounces and a half;
Cinnamon in fine powder, two ounces and a half;
Proof-spirit, two pints.
Digest for seven days; strain and express strongly the residuum; filter the liquors. This tincture may also be prepared by the process of percolation, the mixed powders being put into the percolator without being previously moistened with the spirit.

Process, *Lond. Dub.* Take of

Catechu, three ounces (and a half, L.); Cinnamon, bruised, two ounces (and a-half, L.); Proof-spirit, two (old-wine, D.) pints. Macerate for seven days, and then strain.

FOR. NAMES.—*Fren.* Cachou.—*Ital.* Catecu.—*Span.* Catecu.—*Port.* Cato.—*Ger.* Catechu; Cachou.—*Dan.* Japonisk jord.—*Russ.* Catechu.—*Tam.* Cuttacamboo; Cashcuttie.—*Hind.* Cutt.—*Malay,* Gambir.

FIGURES of Acacia Catechu in Nees von E. 337. Hayne, vii. 48. Steph. and Ch. ii. 76. Roxb. Cor. Pl. ii. 175.—Of Areca Catechu in Nees von E. 38. Hayne, vii. 35. Roxb. Cor. Pl. i. 75.—Of Uncaria Gambir in Nees von E. Suppl. 64, and as Nauclea Gambir in Hayne, x. iii.—Linn. Trans. ix. 22.

CATECHU (*Cutch; Cutt; Gambeer; Terra japonica;*) has been known from a remote period, and is believed by some, but without sufficient reason, to have been the Λυκιον of Dioscorides. Its modern designation is derived from its Hindoo name, *Cutt.*

Natural History. — Its natural and pharmaceutic history has been rendered complex through the demand which has recently arisen for it in the trades of the dyer, calico-printer, and tanner. New varieties, and old ones in new forms, appear in succession in the market. The number of commercial catechus is consequently considerable; and notwithstanding the attention lately devoted to the subject by M. Guibourt in France, and Dr Pereira in London, their sources, external characters, and chemical constitution are far from being hitherto accurately known. On account of their commercial importance and their great consumption in various trades, they deserve more attention than they may be entitled to merely by reason of their medicinal interest; for their actions and medical uses are exceedingly simple.

A substance of the nature of catechu might be prepared from many astringent roots, woods, barks, and fruits. Three distinct species of plants are already known to yield it, namely, *Areca Catechu, Acacia Catechu,* and *Uncaria Gambir;* and probably other plants are in use for the purpose. The London College is clearly wrong in restricting the botanical reference to the second of these species; for a considerable part of what is now used by druggists is the undoubted produce of *Uncaria Gambir.*

1. The *Acacia Catechu* of existing botanists, the *Mimosa Catechu* of Linnæus, belonging to the Natural family *Leguminosæ,* and to the class and order *Monadelphia Polyandria* in the sexual arrangement, produces a great part of the catechu from the Indian continent. This is a shrub about twelve feet high, abounding in India, where it is called the *khire* or *koyra* tree, and thriving particularly in the hilly parts of the Bengal province of Behar, as well as on the Malabar and Coromandel coasts, and throughout the Burmese empire. Mr Kerr in 1775 first accurately described the preparation of catechu from this plant after witnessing the process in Behar (Med. Obs. and Inq.); and Major Mackintosh has described it again from personal observation on the Malabar coast (Proceed. of Bomb. Geog. Soc. 1838). According to the latter authority Cutt is there prepared by a particular sect, named Cuttcuries, in-

habiting Attavecssy and Northern Konkan. During the cold season early in November they cut down those plants only whose inner wood is red, and remove the paler alburnum along with the bark. The remaining inner wood is cut into chips and boiled some hours in water, until the decoction is sufficiently concentrated to become on cooling a tough extract; and this is immediately divided into masses about the size of a small orange, and dried slowly in the shade, because the sunshine blackens them. The product constitutes the principal part of the Ball-catechu of the English market. Mr Howard Malcolm has recently stated from personal observation, that catechu is prepared from the same species by a similar process near Prome in the Burmese territories (Travels in the Burman Emp.) This is probably the Pegue cutch, or Lump catechu, of the English market.

2. The *Areca Catechu*, or Betel-nut tree, is a beautiful palm, inhabiting most of the Indian continent and islands, flourishing especially on the Coromandel and Malabar coasts, and extensively cultivated there, as well as elsewhere, for its fruit. It is between thirty and forty feet high, bears a magnificent head of leaves about fifteen feet long, and produces clusters of numerous flowers, which are succeeded by orange-coloured drupes about the size and form of a hen's egg. The fruit consists of a coarsely-fibrous, thick, somewhat fatty sarcocarp, and a hard, yet pulverizable, roundish seed, about three-quarters of an inch in diameter, and marbled internally like the nutmeg. This seed, which is strongly astringent to the taste, has long been much used under the name of Betel-nut in the composition of the substance called Betel, which is prevalently chewed by the Malays of the eastern islands. It is said that from Sumatra alone 100,000 hundredweight are annually exported for this purpose. The seed, according to Morin, contains a large proportion of tannin, with a little stearin, gum, and other unimportant ingredients. From the time of Clusius till a recent date it was thought to be the chief source of commercial catechu; and in the year 1800 Dr Heyne of the East-India Company's service ascertained that it was really used for the purpose near Sirah in Mysore, and that the process consisted in concentrating a decoction of the entire seeds (Tracts Hist. and Stat. 1814). The produce of the first decoction is a coarse kind called Kassu; and the second decoction yields a superior variety termed Coury. Late inquiries by Dr Pereira render it most probable that this is the source of a variety of catechu from Ceylon, known in the London markets by the name of Colombo, or, erroneously, Columbia, Catechu.

3. The *Uncaria Gambir* of Roxburgh, Decandolle, and Lindley,—the *Nauclea Gambir* of Nees von Esenbeck, of Richard, and also of Mr Hunter, who was the first to describe it fully (Linn. Trans. ix.)—is a trailing shrub belonging to the Linnæan class and order *Pentandria Monogynia*, and to the Natural family *Rubiaceæ* of Decandolle, or *Cinchonaceæ* of Lindley. It is a native of Malacca,

Sumatra, Prince of Wales' island, Cochin-china and other parts of eastern Asia. Catechu is extensively prepared from a decoction of its leaves. Mr Hunter has described the process followed in Prince of Wales' island. The plant is there widely cultivated for the purpose, generally in a sloping situation on a rich red soil exposed to frequent rains. The leaves are cut twice a-year and immediately boiled in water; and the decoction, duly concentrated, is run into square or parallelopiped moulds. Nine pounds of leaves yield about ten ounces of dry extract; and eighty yards square of good ground will produce 1335 pounds annually. Two sorts are thus obtained, one of a light hair-brown externally, but pale yellowish-brown within, the other equally yellowish-brown internally and externally. It is also stated, that a pale-gray sort is prepared in the form of small lozenges in Sumatra by inspissating in the sun the feculence which subsides from an infusion of the leaves and young twigs in water; but this does not seem a probable account of the process (Linn. Trans. ix. 1807). The three catechus from the Uncaria are called at Singapore Black, Brown, and White Gambeer. The first is now very common in the English market; the second is less frequent; the third, which is most esteemed in eastern Asia, is seen in Europe only in cabinet specimens.

The *Butea frondosa* or Dhak-tree of the East-Indies, a magnificent tree, belonging to the Natural family *Leguminosæ*, has been supposed by Guibourt to be also one of the sources of catechu. But his reasons are not satisfactory; and no commercial variety can be traced to it.

Catechu is imported into England chiefly from Bombay, Calcutta, Singapore, Colombo, and Pegue. The number of its commercial kinds is great; for M. Guibourt has determined ten, and his list does not include the three varieties of Gambeer. It is difficult to arrange and define them accurately. The most important of them are the following, which I have arranged according to the external characters of colour and form. They may first be divided into Brown, Yellow and Gray catechus from the colour of their fresh fracture.

The Brown Catechus include those whose colour ranges from deep chocolate-brown to arnatto-red. They are commonly compact; their fracture is uneven, splintery, sometimes with small conchoidal depressions; their lustre, though in one variety dull, is more generally glistening or even resinous; and they all agree in imparting a reddish colour to the saliva. This division comprises three commercial kinds, called Ball, Lump, and Colombo catechu. ——1. Ball-catechu was long the chief kind used in English medicine. The common sort of it is in irregular balls between two and four ounces in weight, commonly flattened into trapezoidal forms by mutual contact while soft. Its surface is covered with rice-husks or their impressions. It is dense and rather hard. Its fresh fracture has a nearly uniform deep chocolate-brown colour.

It is less friable than almost any other sort. What I have seen of this kind has a rather weak astringent taste, with feeble bitterness and a sweetish after-taste; but the superior qualities present a redder tint, an undulated or marbled appearance internally, little or no lustre, more friability, and a strong pure astringent taste followed by an agreeable sweetness, without any bitterness [Guibourt]. The former contains, according to my experiments, never more than 38.2, seldom above 35.5 per cent of tannin. This common sort used to come chiefly from Bombay, but partly too from Calcutta. It is the kind which Mr Kerr and Major Mackintosh saw made from the wood of the Acacia catechu. I suppose it to be the Cashcuttie variety of India, from specimens sent under that name to my predecessor Dr Duncan and now in the University collection.——2. LUMP CATECHU is of more recent introduction into the European market. It forms large masses, weighing eighty pounds and upwards, and composed of slightly flattened coherent lumps as big as an orange, of uniform texture, and partially separated from one another by being wrapped in large leaves. It presents on a fresh fracture a hair-brown, arnatto-red, chocolate-brown, or brownish-black colour, an almost resinous lustre, considerable brittleness, and a powerful astringent taste, with no great bitterness, and a feebly sweet after-taste. Its botanical source is not accurately known. M. Guibourt, finding the leaves of *Butea frondosa* in his specimens, inferred that Lump catechu might be obtained from that plant. But the fragments of leaves in a French specimen which I owe to M. Guibourt's kindness, do not present the characters of the Butea leaf; neither have I been able to find any such leaf in my English specimens. I have two fine specimens of this sort, one of which I cannot trace to its commercial source; but the other came to Leith from Pegue by way of Calcutta. The former is dark arnatto-red; the other has a dark chocolate-brown, almost black hue; and both consist of agglomerated masses nearly as big as the fist, and wrapped in the leaves of two species of plants, which seem identical in both specimens, and neither of which belongs to the *Butea frondosa*. Judging of them by the taste, these catechus must be of superior quality. In all probability they are substantially the same, and come alike from Pegue; and if so, they are the cutch described by Mr Malcolm as made there from the wood of the *Acacia Catechu*.——3. COLOMBO CATECHU is in flat circular cakes, about five inches in diameter, and half an inch thick. It is completely covered with rice-husks and their impressions. It is dense, rather hard, not so crumbly in the mouth as other fine catechus, uniform in texture, of a dark reddish-brown colour internally, and resinous in lustre on a recent fracture. Its taste is powerfully astringent, slightly bitter, and afterwards obscurely sweetish. It is of recent introduction into English commerce, in which it was at first known by the incorrect name of Columbia catechu, and thought to come from South America. The inquiries of Dr Pereira have traced it

to Colombo, and probably to *Areca catechu* as its botanical source. Amongst catechus it must rank high; for it is intensely astringent, and I have got 53 per cent of tannin from it. I have a somewhat similar article from M. Guibourt, but in large irregular lumps, which has come under his notice in France as Columbia kino.

The YELLOW CATECHUS are distinguished by their fresh surface having a grayish-yellow colour like that of the paler sort of bricks. They are much lighter than the brown catechus, much more brittle, and friable. Their fracture is even, earthy, and quite dull; and they readily communicate an ochrey colour to the saliva when chewed. Under this division may be arranged two varieties of commercial catechus, which are closely related to one another.—1. DARK GAMBEER is a term which may be conveniently applied to a species of catechu of rather recent introduction into the English market, but already in general use, and not without reason. It is in cubes about an inch every way, and about half an ounce in weight. It is pale liver-brown on the exterior, but internally of the generic grayish-yellow hue. It is very easily broken, and quickly becomes a pulp when chewed. A fresh surface presents an earthy fracture and no lustre in the centre; but there is often a thin outer crust, where the fracture is chocolate-brown, somewhat conchoidal, and of resinous lustre, like the Brown catechus. Its interior often presents round, pale gray specks, sometimes radiated, with an approach to crystallization; and it has a powerfully astringent, feebly bitter taste, followed by a distinct sweet after-taste. This kind comes to England from Singapore. It is one of those manufactured in Malacca and the adjacent islands from the leaves of *Uncaria Gambir.* I have received fine specimens of it direct from Singapore, where its commercial name is Black Gambeer; but I have taken the liberty of altering a title so inappropriate. It is the cheapest of the gambeers, being the least esteemed of all by the Malays for making betel; but it is the most prized in Europe, for it is the most astringent of them. It appears to me to be of fine quality when genuine.—In the last edition of this work I described as a distinct sort of yellow catechu what I am now persuaded is merely an inferior variety of Dark Gambeer. My predecessor's collection contains a specimen of it under the Tamool name of Cuttacamboo; I have also received it from Liverpool under the name of Terra Japonica, the old generic name of catechu; and M. Guibourt has described the same sort under the title of Cubic Resinous catechu. It does not present any specific difference from the Black Gambeer of Singapore trade.—2. PALE GAMBEER differs from the last species in form, external colour, and strength. It is made up in parallelopipeds, about an inch long, and forty grains in weight. Its colour on the outer surface, as well as within, is pale grayish-yellow; and its taste is rather less astringent, but its after-taste somewhat sweeter, than in the instance of Dark gambeer. It is obtained like that species from Singapore, where it is

prepared from the same plant; and the lightness of its colour is said to arise from younger leaves being used, and from the employment of a better quality of iron pot for concentrating the decoction. I have not seen it as a commercial article in this country, my specimens having been sent directly from Singapore, where it is called Yellow gambeer to distinguish it from the last kind. It is more fancied in the East by betel-chewers, but is somewhat inferior for European purposes. Still, from the experiments I have made, it must be arranged with the finer qualities of catechu.——There is in my predecessor's collection a specimen apparently of this variety in flat circular cakes about the size of half a crown, but thrice as thick, and marked Cuttacamboo; and Mr Bennett has recently described gambeer as sometimes made up in this form in the Straits of Malacca.

The Gray Catechus are of little consequence in Europe. They present scarcely any character in common except their colour, which is pale-gray; sometimes inclining to white. They comprehend two species, which may be called Hard Gray catechu, and Gray gambeer.—1. Hard Gray Catechu, a rare sort in European commerce, and which I have hitherto seen only in the collections of Dr Pereira and M. Guibourt, is in roundish cakes an inch and upwards in diameter, almost black on the surface, heavy and hard, pale grayish-white and dull within, and in taste astringent, very bitter, scarcely sweet, but rather with a smoky after-taste. Its commercial origin is not known. Druggists call it White catechu.—2. Gray Gambeer is the third of the Singapore kinds obtained from the *Uncaria Gambir*. It is quite different in appearance from every other sort. It is in little lozenges, of the form of peppermint-drops, and about five grains in weight. Its colour is uniform pale-gray, slightly inclining to yellow. It is as friable as the masses of Prepared chalk. Its taste is feebly astringent. This kind, which in the east is called White gambeer, is said by Hunter to be made in Sumatra by drying in the sun the feculence which subsides from an infusion of the leaves. Though more esteemed than any other by the Malays, it is not likely to come into demand in Europe; for it has comparatively little astringency, and contains little tannin. I have two specimens of this sort, one of which contains some starch, but the other is free of that ingredient. I have also a third specimen, destitute of starch, and made up in flat circular cakes, about an inch in diameter. All these were sent to me directly from Singapore.

Other astringent extracts are occasionally met with, to which the name of catechu is given; but they are mostly of rare occurrence in Europe, and all either low in quality or counterfeit. M. Guibourt describes a variety in small, flat, oblong cakes, composed of layers, and adulterated with starch;—another in parallelopipeds, which is black internally, astringent and mucilaginous to the taste, and probably altogether spurious;—a third, of common

occurrence in France, in roundish or flattened masses about a pound in weight, brown, compact and heavy, and which, as it contains a fourth part of earthy matter, is also spurious;—a fourth in segments of hemispherical masses originally about ten ounces in weight, brownish-black, shining, smoky as well as astringent to the taste, and believed to be prepared in France to imitate the true catechus,—and a fifth in small cubes half an inch in the side, dark-brown externally, pale-brown and dull within, and containing more than 50 per cent of starch, which seems to have been mixed with it in India, whence it is supposed to come. An imitation of Pegue catechu is met with in Liverpool, which is said to be an extract prepared from a cold watery infusion of gambeer [Maclagan].——I have small specimens of several inferior varieties of catechu sent to me from different parts of India; which it would be unprofitable to describe, as they are not known in commerce. The spurious and inferior catechus are indeed too numerous for notice here.

Chemical History.—Catechu when heated, softens, froths up, and afterwards chars. When of good quality it is in a great measure soluble in water. Small successive portions of cold water remove chiefly tannin, its astringent part; and a much larger proportion of water is required to dissolve the remainder, which is principally a substance with acid properties, called catechuic acid. Hot water dissolves both principles readily, and is therefore used for making the pharmaceutic *Infusum Catechu*, one of its best medicinal preparations. A strong hot infusion deposites a reddish matter on cooling. The action of reagents on the watery solution of catechu is much the same as on the more familiar infusion of galls. The solution is reddish-brown if concentrated, yellowish-brown when diluted. It is strongly astringent to the taste, and it faintly reddens litmus. It yields precipitates, if concentrated, with sulphuric or muriatic acid, and in its diluted state, with solutions of the pure earths, with the salts of alumina, lead, copper, as well as many other metals, and more especially with the salts of sesquioxide of iron, which colour the solution deep green, and throw down deep greenish-black flakes. The particular tint of this ferruginous precipitate distinguishes catechu and many other astringents from another series of which galls constitute the type, and which yield bluish-black precipitates with chalybeate salts. Infusions of catechu also give a curdy precipitate with the animal principle gelatin; a property which constitutes the ground of their now general employment in tanning hides. They likewise cause precipitates in solutions of the salts of the vegetable alkaloids, in consequence of the alkaloids forming insoluble salts with tannin; a fact which must not be lost sight of in prescribing opium, cinchona and other alkaloidal drugs along with catechu. Alcohol and proof-spirit dissolve catechu more readily than water, taking up both of its principles, and forming reddish-brown solutions, of strong astringency. The latter solvent is properly used for making the officinal

Tinctura catechu; which is most conveniently and quickly made, as the Edinburgh College has indicated, by percolating the dry powder with the spirit. Sulphuric ether removes from some catechus tannin only, but from others catechuic acid also. A wine-yellow solution is thus obtained from the Indian catechus; and on removing the ether by partial distillation and subsequent spontaneous evaporation, an amorphous, garnet-red, resinous-like matter is obtained which is pretty pure tannin, mostly soluble in water. But the etherial solution of the gambeers, when similarly treated, yields a pale yellow, or pale grayish-white residuum, sometimes crystallized in cauliflower-like masses, partially soluble in water, and composed of tannin and catechuic acid. The residue of the action of water and alcohol is chiefly earthy matter, if the catechu be pure.

The nature and composition of this drug have been investigated by Sir Humphrey Davy, Trommsdorff, Runge, Nees von Esenbeck, and others. It consists in a great measure of tannin, a resinoid substance of acid properties, and common extractive matter; and all other ingredients which have been indicated in it are probably adventitious. The tannin or tannic acid is nearly identical with that from galls, under the head of which article it will be found fully described. But it yields green, not blue precipitates, like gall-tannin, with the salts of sesquioxide of iron; and the brown precipitate caused in its watery infusion by bichromate of potash is insoluble in hydrochloric acid. It may be obtained from some brown catechus in a state of considerable purity by evaporating an etherial solution, and from all other kinds by acting on the etherial extract with cold water, and evaporating this aqueous solution. The other principal ingredient which has been variously called extractive, resinoid matter, and resinous tannin by different experimentalists, is now considered a peculiar acid under the name of Catechuic acid. It is obtained by removing tannin from Gambeer with cold water, exhausting the dried residuum with warm alcohol, distilling off half the spirit, filtering the cold liquor, evaporating it at 100° F. to one-half, and setting what remains aside to crystallize (Berzelius). The crystals are easily fusible,—soluble in three or four parts of boiling water, but only in 1130 parts at ordinary temperatures,—soluble in six parts of cold, and three of boiling alcohol, and in 120 of cold ether,—and capable of neutralizing bases feebly, and of absorbing oxygen powerfully when combined with alkalis. They consist of seven equivalents of carbon, four of hydrogen, and four of oxygen, arranged probably as a hydrate ($C^7H^3O^3+HO$); and Delffs, the author of this analysis, thinks catechuic acid is formed by oxidation of tannin, whose composition is $C^9H^3O^3$. It abounds more in the gambeers than in the brown catechus, and it constitutes the semicrystalline specks described above as occasionally observed on a fresh fracture of the dark variety of gambeer. Besides tannin and catechuic acid, the

different kinds of catechu contain common extractive matter, which is most abundant in the brown kinds; some contain starch, which must be adventitious; and various other impurities are met with. —There is no good quantitative analysis of the different kinds. Davy found in what he has called Bombay and Bengal catechu 54.5 and 48.5 per cent of tannin; but these names are not commercial, and cannot now be identified. The extremes are probably 28.0 and 54 per cent. Trommsdorff says he once got no less than 71 per cent of tannin; but the accuracy of this result is questionable. The superior qualities of Cutch, or brown catechu, are probably the richest in tannin.

Adulterations.—Catechu is much subject to adulteration,—the fine with the inferior qualities, and all with foreign admixtures, among which starch, clay, and other earthy matters are specially mentioned by authors. Genuine catechu is known by its external characters,—by being easily chewed into a pulp free of sandiness, —by its strong astringency, followed by a sweet after-taste, but no great bitterness,—and by its being in a great measure soluble in cold water. The presence of starch may be ascertained by tincture of iodine occasioning a blue precipitate with a cooled decoction; and earthy matters are best detected by the process of incineration. The most satisfactory test of purity and relative value is the solvent power of ether. The Edinburgh College has adopted this test; but an important omission has been accidentally made in the statement of it. It directs the value of the catechu to be determined by the weight of the dry residuum of its etherial solution. This residuum, as Dr Pereira has observed, may contain catechuic acid. Hence it becomes necessary to deduct from it the weight of what is left when the residuum is acted on by cold water, which dissolves the tannin and leaves the catechuic acid. The proportion soluble in both ether and cold water should amount to at least 38 or 40 per cent of the catechu; and indeed superior catechu yields more. If the proportion be less, the article has either been inferior from the first, or adulterated afterwards.

Actions and Uses.—Catechu in its action is a pure and powerful astringent. As such, it is antiseptic in relation to animal substances; some of which it chemically alters in consequence of its tannin uniting with the gelatin contained in them. This is the principle of its operation in the conversion of hides into leather, for which purpose it is now much used by tanners. Its applications to the treatment of diseases are simple, but extensive. It is employed for arresting increased mucous discharges, for removing relaxation or congestion of mucous membranes, and for checking hæmorrhagies. It is an excellent remedy, especially along with opium, for checking the liquid discharges in ordinary chronic diarrhœa and dysentery, as well as for mitigating the diarrhœa of pulmonary consumption. It seems also to have a similar effect indirectly in chronic catarrh. For these purposes it is best given in the form of the

officinal infusion, the strong astringent taste of which may be covered in part by mucilage or sugar. It is one of the most convenient and effectual means of removing chronic cynanche tonsillaris, aphthous ulcerations of the mouth, elongation of the uvula, and relaxation and congestion of the mucous membrane of the fauces, especially of the kind to which public singers are subject, and likewise congestion, tenderness, and sponginess of the gums, particularly when consequent upon the use of mercury as a sialagogue. For the last purpose it is best applied in fine powder with a soft tooth-brush. For the other local purposes here mentioned the infusion may be used as a wash or gargle; or a few grains of the more friable catechus, such as the dark and pale gambeers, may be chewed occasionally. Catechu is of some utility also in the passive hæmorrhagies as a constitutional astringent; but among vegetable substances of this nature kino has been commonly preferred in such diseases. It is thought by some to be likewise serviceable in the same manner in sweating connected with debility. Like other powerful vegetable astringents it sometimes arrests intermittent fever; but it cannot be relied on for that object. In the East it is widely used as one of the ingredients of Betel. This consists of a mixture of catechu, powdered areca-nut, and lime, wrapt in a leaf of the *Piper Betel*; to which is sometimes added opium, tobacco, or a preparation of hemp called Bhang. The practice of chewing betel is so universal among the Malay nations, that it must have some grateful or salutary effect. Yet, apart from the narcotics which are used by some only, little effect would be looked for from its component parts beyond a local stimulant and astringent action.——In administering catechu care must be taken not to give it along with preparations of iron. The natural and artificial salts of the vegetable alkaloids, such as opium, cinchona, and muriate of morphia, are also in some measure incompatible with it; nevertheless the alkaloidal tannates then formed, though insoluble in water, are perhaps sufficiently soluble in the gastric juice, to possess active properties.

The doses of its preparations are: *Catechu*, gr. v. ad gr. xx. *Infusum catechu*, E. *Infusum catechu compositum*, L. D. fl. unc. i. ad fl. unc. iii. *Tinctura catechu*, E. L. D. fl. dr. i. ad fl. dr. ii. *Electuarium catechu*, E. *Electuarium catechu compositum*, D. scr. i. ad dr. i.

CENTAURIUM, *E. L.* CENTAUREUM, *D.* *The flowering heads (herb, Lond. leaves, Dub.) of Erythræa Centaurium Persoon, Synops.—Spr. Common Centaury.*

FOR. NAMES.—*Fren.* Centaurée petite.—*Ital.* Centaurea minore; Biondella — *Span.* Centaura menor.—*Port.* Centaurea menor.—*Ger.* Tausendgüldenkraut. —*Dut.* Duizendguldenkruid.—*Swed.* Tusengyllen.—*Dan.* Tusindgylden.

FIGURES of Erythræa Centaurium as Chironia Centaurium in Hayne, i. 29,—as Gentiana Centaurium in Nees von E. 203.—Eng. Bot. 417.—Steph. and Ch. iii. 118.

This plant, the common Centaury of our fields, the *Erythræa Centaurium* of most botanists of the present day, and *Chironia Centaurium* of Smith, has been retained in the Pharmacopœias chiefly as a good indigenous bitter, used in domestic medicine; but it is now scarcely employed in regular practice. It belongs to the family *Gentianaceæ,* and to Linnæus's class and order *Pentandria Monogynia.* It is an elegant little annual between six inches and a foot in height, which thrives in sandy pastures, flowers in July and August, and is easily known by its small pinkish flowers and its purely bitter, gentian taste. Every part of the plant is bitter, except, according to Nees von Esenbeck, the flowers; and the London College is therefore more exact than the other colleges, when it enjoins the whole herb to be made use of.

Centaury possesses precisely the properties of Gentian and the other species of the same characteristic natural order. Being a pure bitter, it may be given in the form of infusion as a stomachic and tonic wherever gentian-root is used; but it is less powerful.

CEPHAËLIS. See *Ipecacuanha.*

CEPA, *D.* *Bulb of Allium Cepa, L. W. Spr.* *Onion.*

For. Names.—*Fren.* Ognon.—*Ital.* Cipolla; Bulbo.—*Span.* Cebolla.—*Ger.* Zwiebel; Bolle.—*Dut.* Ajuin. *Swed.* Rödlök.—*Dan.* Log.—*Arab.* Bussul.—*Pers.* Peeaz.—*Tam.* Venggaum.

The Onion is the Κρομμυον of the Greeks, and Cepa of the Romans. Its native country is supposed to be Egypt; but it is cultivated in every part of Europe as an article of diet. It belongs to the Natural family *Liliaceæ,* and to the Linnæan class and order *Hexandria Monogynia.* It is a bulbous plant, and the bulb is its only official part. It contains gum, sugar, albumen, and an acrid volatile oil, besides other unimportant principles. The oil is in a great measure dispersed by ebullition in water, so that the bulb, from being acrid, acquires a comparatively bland taste.——Onions are nutritive, and also act the part of a condiment; but in large quantity they favour the production of flatus. They are not put to any use internally. Although sometimes applied in the roasted state in domestic practice to suppurating tumours, or in the form of poultice as a stimulant to indolent or foul ulcers, they may be expunged without loss from the Dublin Pharmacopœia, as they have already been by the two other Colleges.

CERA, *L.* CERA FLAVA, *E. D.* *Concretion* (*Lond.*) *Waxy secretion* (*Edin.*) *from Apis mellifica.* *Bees'-wax.*

CERA ALBA, *E. L. D.* *Bleached Bees'-wax.* *White-wax.*

Ceratum, L.

Process, *Lond.* Take of
White-wax, four ounces;
Olive oil, four fluidounces.
Melt the wax, add the oil, and mix them.

CERATUM SIMPLEX, E. CERATUM CETACEI, L.

PROCESS, *Edin.* Take of
Olive oil, six parts, (a pint, L.)
White wax, three parts, (8 ounces, L.)
Spermaceti, one part, (two ounces, L.)
Heat the oil gently; add the wax and spermaceti; stir the whole briskly, when it is fluid, and continue the agitation as it cools.

UNGUENTUM CERAE ALBAE, D.

PROCESS, *Dub.* Take of
White-wax, a pound;
Lard, four pounds.
Make them into an ointment.

UNGUENTUM CERAE FLAVAE, D.

PROCESS, *Dub.* To be prepared with yellow-wax in the same manner as the *Unguentum Ceræ albæ.*

EMPLASTRUM SIMPLEX, E. EMPLASTRUM CERAE, L.

PROCESS, *Edin.* Take of
Wax, four ounces;
Suet, and
Resin, of each two ounces.
Melt them together with a moderate heat, and then stir the mixture briskly till it concretes on cooling.

PROCESS, *Lond.* Take of
Wax, and
Suet, three pounds;
Resin, a pound.
melt them together, and strain.

LINIMENTUM SIMPLEX, E.

PROCESS, *Edin.* Take of
Olive oil, four parts;
White wax, one part.
Dissolve the wax in the oil with a gentle heat, and stir well as the fused mass cools and concretes.

FOR. NAMES.—*Fren.* Cire.—*Ital. Span.* and *Port.* Cera.—*Ger.* Wachs.—*Dut.* Was.—*Swed.* Wax.—*Dan.* Vox.—*Russ.* Ptshela.—*Arab.* Shuma.—*Pers.* Moam. —*Tam.* Mellugoe.

Natural History.—WAX, the Κηρος of the Greek, and *Cera* of the Roman physicians, is a peculiar substance which occurs in small proportion in the textures or juices of plants, and is sometimes secreted on the surface of their organs. But it is formed in the largest quantity by the common Bee, the *Apis mellifica* of naturalists. It is not simply transferred from plants to the body of the insect, as was once imagined, but is discharged by secretion upon the scales covering the abdomen; whence it is afterwards removed by the insect for constructing cells for food and ova. It is obtained for medical use, after the honey has dripped or been expressed from the comb, by fusing what remains in boiling water, and straining the melted mass. This constitutes the Yellow-wax of commerce, the *Cera* of the London College, and *Cera flava* of the Edinburgh and Dublin Pharmacopœias. It has a grayish-yellow colour, considerable firmness and tenacity, a feeble translucency, a dull lustre, a peculiar rather agreeable odour, scarcely any taste, and no greasiness to the touch. It melts about 142° F. When exposed in thin layers or ribbons to air, sunshine, and moisture, it loses its colour and in a great measure its odour, and becomes at length pale yellowish-white. In this state it constitutes the white-wax of the shops, the *Cera alba* of the Pharmacopœias. Of this there are two varieties, one of which called German-wax, and brought from Hamburg, is rather yellower, somewhat more translucent, harder, and less easily fusible, than the other; which is called English-wax, and is prepared in Britain. German-wax, on account of its superior hardness is the more esteemed of the two, especially by dentists

and others for moulding. The greater softness of English-wax seems owing to the admixture of spermaceti and fatty matters, added for the purpose of increasing its whiteness.

Chemical History.—White-wax has a density of 966. It fuses about 155° F; at a higher temperature it boils, and in close vessels distils over with little alteration; and at a red heat its vapour takes fire in the air and burns with a bright dense white flame. It is insoluble in water, scarcely soluble in cold alcohol or ether, but soluble in about twenty parts of either at their respective boiling temperatures. It readily dissolves in fixed as well as volatile oils, and combines by fusion with fats and resins; which property forms the basis of its employment in the preparation of ointments, cerates, liniments and plasters. It is imperfectly saponified by boiling caustic alkaline solutions. It consists, according to John, of two proximate principles, Cerin and Myricin,—the latter fusible at 149°, very sparingly soluble even in boiling alcohol, and incapable of undergoing saponification,—the former fusible at 143°, soluble in boiling alcohol, and convertible by boiling caustic potash into margarate of potash and a new waxy principle called Ceraïn (Boudet and Boissenot) which melts at 158°, and, like myricin, does not dissolve in boiling alcohol, or form a soap with alkalis. These three principles, cerin, myricin, and ceraïn have been lately stated by Ettling to be isomeric, and to consist of eighteen equivalents of carbon, nineteen of hydrogen and one of oxygen. But more recently Hess affirms that they are not distinct principles at all, and that wax is essentially a single proximate principle, whose composition is twenty equivalents of carbon, the same of hydrogen, and one of oxygen ($C^{20}H^{20}O$).

Adulterations.—Wax is subject to be adulterated with starch or other amylaceous substances, resin, spermaceti, tallow or other fats, oxide of lead, and earthy matters. Starchy substances are detected by the action of tincture of iodine on boiling water which has been agitated with wax and then cooled,—resin by the solvent action of cold alcohol, which removes nothing from pure wax,—earths or oxide of lead by a residuum being left on melting and filtering it,—and fats by imparting to the wax greasiness and greater fusibility, when their proportion is considerable, or, when it is small, by hot lime-water becoming muddy on being agitated with chips of the wax, and then allowed to rest.

Actions and Uses.—Wax is a local emollient. It has been used internally as a remedy for dysentery; but it is now only employed as an external agent, and it forms an important part and large proportion of many ointments, cerates and plasters, to which it imparts due consistence and tenacity. Its simpler preparations have been placed at the head of this article.

CEREVISIAE FERMENTUM, *L. D.* *Yeast.*

CATAPLASMA FERMENTI, L. D.

PROCESS, *Lond. Dub.* Take of
Wheat-flour, a pound;
Yeast, half a pint (pound, D.)
Mix them, and heat them gently till they swell up.

FOR. NAMES. — *Fren.* Levure.—*Ital.* Fermento.—*Span.* Levadura.—*Port.* Escuma de cerveja.—*Ger.* Gäscht; Hefen.—*Dut.* Gist.

Chemical History.—WHEN an infusion of malt, technically called Wort, is subjected to the process of fermentation, a dirty grayish-brown substance gradually separates, forming in part a frothy scum, and partly a sediment. This is Yeast or barm. It is a very mixed substance, containing, besides water and alcohol, carbonic, acetic, and malic acids, potash and lime, and saccharo-mucilaginous extract. But its chief and essential ingredient is a congeries of microscopic globules, which are now usually considered as organized cells, of a vegetable nature, and endowed with vitality. The only important property possessed by yeast, which requires mention here is, that, when put in contact with saccharine solutions at a temperature between 50° and 80°, it causes them to ferment, and the sugar is in consequence converted into carbonic acid and alcohol (see *Saccharum*). This property depends on the presence of the globules or cells. It is much impaired by drying the yeast, and destroyed by a heat of 212°, or by trituration continued until the globules are all burst and lose their structure.

Actions and Uses.—Yeast was recommended not long ago, both by the mouth and in the way of injection, as a stimulant and tonic remedy in typhoid fever, and as a carminative injection in tympanitis. But it has never come into general use. It is sometimes employed for making stimulant cataplasms, which have appeared serviceable in foul or malignant ulcers. According to Dr Pereira, the fetor is corrected, and the separation of sloughs often promoted; but patients sometimes complain of severe pain. The London and Dublin Colleges have introduced into their respective Pharmacopœias, a *Cataplasma fermenti,* composed of two parts of wheat-flour and one of yeast, well mingled and gently heated.

CETACEUM, *E. L. D.* *Cetin of Physeter macrocephalus, nearly pure (Edin.) A concrete substance found in proper cells in the head of Physeter macrocephalus (Lond.) Spermaceti.*

UNGUENTUM CETACEI, L. D.

PROCESS, *Lond. Dub.* Take of
Spermaceti, six drachms (a pound, D.)
White-wax, two drachms (½ pound, D.)
Olive-oil, three fluidounces, (lard three pounds, D.)
Melt them together with a gentle heat, and stir constantly as the mass cools.

CERATUM CETACEI, L. See *Cera.*

FOR. NAMES.—*Fren.* Blanc de Baleine.—*Ital.* Bianca di balena; Sperma ceti —*Span.* Esperma da ballena.—*Port.* Spermaceti.—*Ger.* Wallrath.—*Swed.* Walraf.—*Dan* Hvalratt.

SPERMACETI is a substance approaching in nature to the concrete fixed oils or fats, and is obtained from the Cachalot or Spermwhale, the *Physeter macrocephalus* of naturalists, a species of the family *Cetacea*. It is doubtful whether the ancients were acquainted with this animal. Some have conjectured that it may have been the Φυσητης of the Greeks, or *Orca* of the Latins.

Natural History.—The cachalot is a gregarious whale, met with at times in various climates, but inhabiting particularly the Pacific, the waters of the Indian Archipelago, and the Chinese seas. It has been occasionally seen about seventy feet long and thirty feet in circumference. It may be at once distinguished from other cetaceous animals by its huge quadrangular head, which constitutes about a third of its whole length. Spermaceti occurs in various parts of its body, being found dissolved in small proportion in its blubber. But what is met with in commerce is entirely obtained from a peculiar structure connected with the head. This structure, which lies over the whole superior surface of the long upper jaw of the animal, is separated from the blubber under the skin by a ligamentous covering; and it is divided into two intercommunicating cavities, one superior in position to the other, between which the nostril passes to the single blow-hole placed in this animal towards its left side. Both cavities are divided into numerous cells full of a milky fluid, amounting in a large whale to about 50 hundredweight, and consisting of an oleaginous solution of spermaceti. The contents of the cavities being removed with buckets, and boiled to separate the oleaginous matter from the solid substance, the spermaceti crystallizes in this fluid as it cools, and is then detached in an impure state by draining off the oil and subjecting what remains to powerful pressure. The crude spermaceti is subsequently purified by fusing and skimming it, then fusing it in weak potash-ley, and finally by a third fusion at a gentle heat; after which it is solidified in tin moulds. It then constitutes the spermaceti of the shops.

Chemical History.—Spermaceti is concrete, crystalline and foliaceous in texture, of the density 943, white, pearly, free of taste and odour, almost without greasiness, pulverisable on the addition of a little rectified spirit, fusible at 112°, combustible, insoluble in water, soluble sparingly in cold rectified spirit, but much more at the boiling temperature, considerably soluble in ether, and readily in volatile oils, fixed oils, or fused fats. In consequence of containing a little oil, it is apt to become rancid when long exposed to the air. This oil being insoluble in boiling rectified spirit, spermaceti may be obtained quite pure by solution in that menstruum and subsequent crystallization. It then becomes the Cetin of chemists, a pure proximate principle, intermediate between wax and the concrete oils, and presenting all the leading properties of spermaceti, but less greasy, rather harder, and fusible only at the higher temperature of 120°. Cetin undergoes partial saponification when

boiled in solution of caustic potash. A brittle soap is formed, only in part soluble in water, and composed chiefly of margarate of potash, oleate of potash, and a crystalline principle called Ethal. This principle differs little in chemical relations from cetin except that it is incapable of undergoing saponification, and that it yields by distillation with phosphoric acid an oleaginous hydro-carbon called Cetene, which is considered to consist of sixteen equivalents of each of its elements ($C^{16}H^{16}$). Ethal is composed of cetene with one equivalent of water ($C^{16}H^{17}O$). Cetin or pure spermaceti consists of 81.66 per cent of carbon, 12.86 hydrogen, and 5.48 oxygen (Chevreul).

Actions and Uses.—Spermaceti was once used internally as an emollient, but is now employed only as an external agent. Its firm consistence, comparative infusibility, and lubricity render it a useful ingredient of various cerates and ointments. Among officinal preparations of this kind it forms part of the *Ceratum cetacei*, L.—*Ceratum calaminæ*, E.—*Ceratum simplex*, E.—*Ceratum cantharidis*, L.—and *Unguentum cetacei*, L. D.

CETRARIA, *E. L.* CETRARIA ISLANDICA, *D.* (*Achar. Synop. Lichenogr.*) *Iceland-moss.*

DECOCTUM CETRARIAE, L.

PROCESS, *Lond.* Take of Cetraria, five drachms; Water, a pint and a half. Boil to a pint and strain.

FOR. NAMES.—*Fren.* Lichen d'Islande.—*Ital.* Lichene.—*Span.* Liquen Islandico.—*Port.* Musgo Islandico.—*Ger.* Islandisches moos.—*Swed.* Islandsmossa.—*Dan.* Islandsk-moss; Fieldgräs.—*Russ.* Islandskoi moch.

FIGURES of Cetraria Islandica in Nees von E. 10.—Engl. Bot. 1330.

Natural History.—ICELAND-MOSS has been long used in medicine as a nutritive and restorative article of diet. It was arranged by Linnæus in his *Cryptogamic* class, in the extensive genus Lichen under the specific name of *Lichen islandicus.* Its present designation of *Cetraria islandica* was assigned to it first by Acharius in his Lichenographia. Its thallus is tough and flexible when moist, grayish-green, passing on the edges to olive-green or chestnut brown, upright, and between an inch and a half and four inches long; and it is divided into many lobes and channelled laciniæ, the extremities of which are toothed, and those bearing fruit broader and blunter than the others. This lichen inhabits the northern countries of Europe, is a native of Britain, and abounds particularly in Iceland, whence Linnæus derived the specific name which is still retained. It has a bitter, mucilaginous, somewhat astringent taste, and is converted into a mucilaginous pulp by long chewing. When dry, it is pulverizable. The dry plant steeped in water absorbs more than its own weight of that fluid.

Chemical History.—The powder yields about three per cent of its weight to cold water, and parts with most of its bitterness. Boiling water dissolves about 65 per cent, and renders the residue ge-

latinous; and a strong decoction becomes a firm jelly on cooling. Boiling alcohol dissolves chiefly the bitter and colouring matters. Weak alkaline solutions act also chiefly on the bitter principle, and constitute the best means of removing its bitter taste. Weak acids do not act differently from cold water. The cold watery decoction is rendered by muriate of iron violet, passing gradually to brown, and by tincture of iodine blue, passing to green. Iceland-moss consists of 44.6 per cent of a principle analogous to starch, 36.2 of starchy lignin, 3.0 of a bitter principle, 7.5 of gum and uncrystallizable sugar, with colouring matter, a little wax, and various salts (Berzelius). The bitter principle which has been lately examined by Herberger and called by him Cetrarin, and which has been used in Italy instead of cinchona-bark, is obtained pure by boiling the coarsely-powdered lichen in four parts of rectified spirit, filtering the solution when tepid, acidulating it with diluted muriatic acid, diluting it with thrice its volume of water, and purifying the crystals which slowly form by squeezing them and washing them with a little ether. As thus obtained it is white, of a pure intense bitter taste, insoluble in water, sparingly soluble in cold alcohol, more so in boiling alcohol or sulphuric ether, and readily in alkaline solutions. The alkalis form permanent compounds with it, from which it may be separated by acids with its original properties unchanged. The acids do not unite with it; but muriatic acid gently heated converts it into a blue colouring matter. It is considered an acid by some, and termed Cetraric acid.——The starch-like principle, called Lichenin, is the most important of the nutritive ingredients of Iceland-moss. It is got by macerating the chopped lichen for twenty-four hours in eighteen parts of water containing a 250th of its weight of carbonate of potash,—straining away the bitter solution without pressure, and removing the rest of it from the residuum by maceration with cold water and simple straining,—boiling the residuum in nine parts of water down to six,—straining the decoction and squeezing what is left in the cloth,—and then allowing the filtered liquor to cool. A firm jelly is thus obtained, which speedily cracks and throws out much of the water, and then dries into a hard, black, glassy-like substance, which is nearly pure lichenin. It may be freed of the black colouring matter by repeating the decoction, straining, cooling, and desiccation; upon which it is obtained of a yellowish colour, tough, and transparent in thin plates [Guérin-Varry.] Cold water renders lichenin gelatinous; boiling water dissolves it, and on cooling a jelly is formed; alcohol and ether do not act on it. Iodine renders its watery solution blue. Like wheat-starch, it is converted by sulphuric acid into sugar, and by nitric acid into oxalic acid. It consists, according to Dr Thomson, of carbon, oxygen and hydrogen in the proportion of ten equivalents of each element; but according to Guérin-Varry it contains one equivalent more of hydrogen. It differs little from soluble starch, or amidin.——The insoluble part of Iceland-moss,

which has been here denominated starchy lignin, constitutes the skeleton of the plant, and is intermediate in properties between ordinary ligneous fibre and lichenin. Like some other varieties of lignin, it swells in boiling water and is therefore probably nutritive.

Actions and Uses.—A jelly prepared from this lichen possesses immemorial reputation as a restorative article of food in exhausting diseases and during convalescence. It is in fact a light article of nourishment; but as usually prepared, without its bitter principle, —which is first removed by steeping it in luke-warm water or weak alkaline ley,—it can scarcely possess any of the recondite restorative virtues once generally conceded to it, and still confided in by some. The antiscorbutic properties ascribed to it by others are also doubtful. As a tonic in convalescence and exhausting diseases its efficacy is injured by depriving it too thoroughly of its cetrarin. This principle, since it is a pure bitter, will in all likelihood prove a useful tonic, and may be the sole source of the tonic virtues ascribed to the lichen. It has even been lately found a good febrifuge in ague; in which respect it is probably on the same footing with other pure bitters. Sixteen grains in divided doses have seemed sufficient to check the disease. Iceland-moss is best given as a jelly, made with the addition of sugar, or also with milk.

CHIMAPHILA, *L.* *See Pyrola.*

CHIRETTA, *E.* *Herb and Root of Agathotes Chirayta.* (*Don in Lond. and Edin. Phil. Mag.* 1836.)—*Chiretta.*

INFUSUM CHIRETTAE, E.

PROCESS, *Edin.* Take of
Chiretta, four drachms;
Boiling water, a pint;

Infuse for two hours and strain through linen or calico.

FOR. NAMES.—*Arab.* and *Tam.* Shayract coochic.—*Hind.* Chiraeeta.

Natural History.—The CHIRAITA or CHIRETTA plant is a recent addition to the Materia Medica of Europe from that of Bengal, where it enjoys much reputation among British as well as native practitioners. It was first described by Fleming in the Asiatic Researches, xi. under the name of *Gentiana Chirayta;* but it has been withdrawn from the gentians by Mr Don, and formed into a new genus with the name of *Agathotes Chirayta.* It belongs to the family *Gentianaceæ*, and to Linnæus's class and order *Pentandria Monogynia.* It is a herbaceous annual, about three feet high, common in the northern parts of India. Every part of the plant has a strong pure bitter taste like that of the European gentians. The whole plant is made use of in medicine, and it seems to be collected when the flower is passing off. The root possesses more bitterness than any other part. The bitterness is readily imparted to water and spirit. The watery infusion is a good pharmaceutic

form, which has been adopted by the Edinburgh College. The plant has not been analyzed. It yields an excellent watery extract like extract of gentian.

Actions and Uses.—The chiretta possesses the family properties of the *Gentianaceæ.* It is an excellent pure bitter, and as such tonic, stomachic, and febrifuge,—quite equal in these respects, and in the opinion of some even superior, to the *Gentiana lutea*, more commonly used in Europe. It has been thought to promote the secretion of bile, as the stools become more yellow under its use: and Dr Jackson, lately of Calcutta, assures me that it has often the effect of restoring the healthy alvine evacuations in costive habits. It is much employed in Bengal for dyspepsia, as a tonic in exhausting diseases as well as in convalescence generally, and along with the seeds of the *Guilandina Bonduc* as a febrifuge in ague and remittent fever. Frequent trials made in this city confirm all that has been said by the practitioners of Bengal as to its efficacy as a tonic and stomachic. It should be taken half an hour before meals.

The doses of its only officinal preparation, the *Infusum Chirettæ*, E., are fl. unc. i. ad fl. unc. iii.

CHLORINEI AQUA, *E. D.* *Concentrated watery solution of chlorine (with a little sulphate of soda, E.) Chlorine water.*

PROCESS, *Edin.* Take of
Muriate of soda, sixty grains;
Sulphuric acid (commercial), two fluidrachms;
Red oxide of lead, three hundred and fifty grains;
Water, eight fluidounces;
Triturate the muriate of soda and oxide together; put them into the water contained in a bottle with a glass stopper; add the acid; agitate occasionally till the red oxide becomes almost white. Allow the insoluble matter to subside before using the liquid.

PROCESS, *Dub.* Take of
Dried muriate of soda, one hundred parts;
Oxide of manganese, thirty parts;
Sulphuric acid, eighty-seven parts;
Water, one hundred and twenty-four parts;
Add the acid gradually to the water, and when cold, pour the mixture on the salt and manganese well mixed in a retort. Apply a gradually increasing heat, and transmit the gas through two hundred parts of distilled water. Stop as soon as effervescence in the retort ceases. Keep the chlorine-water in well-closed glass bottles in a dark place.

FOR. NAMES.—*Fren.* Chlore liquide.—*Ital.* Cloro liquido.—*Ger.* Wässeriges chlor.

Chemical History.—CHLORINE (Oxymuriatic acid) was discovered by Scheele in 1774. It does not exist free in nature, but occurs abundantly in union with metals, forming metallic chlorides. It is obtained in a state of purity, as directed in the Dublin Pharmacopœia, by heating together diluted sulphuric acid, chloride of sodium and black oxide (binoxide) of manganese. In this process chloride of sodium is decomposed; the binoxide of manganese parts with one equivalent of its oxygen to convert the sodium into soda; the soda and protoxide of manganese unite with sulphuric acid; and the chlorine set free is disengaged in the form of a gas. This gas has a greenish-yellow colour, a density of 2.5, and a power-

ful suffocating odour, so irritating as to render it irrespirable unless in very minute proportion to the air. It may be converted into a dark greenish-yellow, mobile fluid by pressure. It supports combustion. It destroys most organic colours if moisture be present; and it corrects putrid effluvia from decaying animal matters. It is soluble in half its volume of water at 60°. The fluid, which constitutes the chlorine-water of the Dublin Pharmacopœia, has a pale greenish-yellow colour, an irritating suffocating odour, and an acrid but not acid taste. It freezes at 32°. It slowly gives off oxygen, owing to the decomposition of water; the hydrogen of which unites with the chlorine and converts it into hydrochloric acid. It is precipitated by nitrate of silver. Like the gas, it promptly destroys vegetable colours and the odour of decaying animal or vegetable matter.—As chlorine-water cannot be kept long and the preparation of it by transmission of the gas through water is an offensive process, owing to the escape of part of the gas, the Edinburgh College has given a formula for preparing it in the liquid way. This consists in agitating together chloride of sodium, red oxide of lead, and sulphuric acid in water, which becomes saturated with chlorine. The red oxide of lead here parts with some of its oxygen to oxidate the sodium; and becoming protoxide of lead, it unites with sulphuric acid to form the white insoluble sulphate of lead; the soda also combines with sulphuric acid, and the sulphate of soda remains in solution, along with the chlorine which is set free. This is a convenient process; but some hours are required to complete it; nor is time much saved by increasing the agitation. The small proportion of sulphate of soda in the solution does not interfere with any of the medicinal uses of the chlorine; and the lead is rendered completely insoluble by uniting with the sulphuric acid.—Chlorine may be readily obtained in large quantity by decomposing a solution of chloride of lime with sulphuric acid; and it may be usefully obtained in small quantity in the same way for the purpose of inhalation, as will be explained presently.

Actions and Uses.—Chlorine is a most powerful irritant, an astringent, and a disinfecting agent; and according to some it is also a deobstruent.——It irritates the skin, causing redness and an eruption of papulæ.—Its solution taken in large quantity irritates and inflames the stomach. If the gas be inhaled nearly pure, the glottis suddenly contracts and refuses admission to it. But if somewhat diluted, it may be inspired and then causes a painful sense of rawness in the throat and down the windpipe into the lungs, with coughing and expectoration; which may be followed by bronchial inflammation. When much diluted with atmospheric air, it merely excites a sense of warmth in the chest, with tickling of the glottis, followed by expectoration and some dryness of the fauces. Notwithstanding its irritating effects on the lungs, it may be breathed in considerable proportion to the air by the force of habit, as in

the case of workmen at manufactories of chloride of lime; and neither any immediate nor ultimate injury appears to result.——It has been held to be an astringent in consequence chiefly of the property ascribed to it of diminishing chronic bronchitis when inhaled. The inhalation of chlorine, which was first recommended by M. Gannal, consists in making the patient inspire the vapour of water weakly impregnated with chlorine through an inhaler, or breathe the gas diffused through the atmosphere of the apartment. The most convenient source of chlorine is a solution of one part of chloride of lime in forty parts of water, which is kept about the temperature of 100°, and which is made to disengage chlorine from time to time, as it is required, by the addition of a drop or two of sulphuric acid. The proper strength must be judged of by experiment. A liquid of due strength may also be made by adding from ten to thirty drops of chlorine-water to six or eight ounces of water in the inhaler. Chlorine inhalations thus practised four or six times a-day have the effect of producing some dryness of the fauces, followed by increased expectoration for a time. The ultimate result however is the diminution of the sputa and progressive amendment. Chlorine inhalations have been found serviceable in chronic catarrh. Gannal, who first suggested them, thought he cured some cases of pulmonary consumption by the same means, and Cottereau confirmed his results by more extensive experiments. More recently, however, a committee of the French Institute pronounced their remedy ineffectual. I have tried it repeatedly; but though I have witnessed much amelioration, I have not met with any instance where this was permanent.——Chlorine has also been considered by some to be a powerful tonic, and on this account has been used in typhoid fever, typhoid scarlatina, and syphilis. It was first used in febrile diseases on theoretical grounds, because it is an oxygenating agent, and also an antiseptic. The older statements of Brathwaite and Willan on this head have been more recently confirmed in the epidemic typhus of Dublin by Dr Graves, and in the typhoid dothinenteritis of Paris by several physicians of that capital. No advantage has been observed from the use of chlorine in the typhus of Edinburgh. It was at one time much employed in syphilis as an oxygenating tonic. Its utility in that disease is now easily understood, as cures are known to be not uncommon under careful regimen and general treatment, without mercury or any other antidote.——By other physicians chlorine has been held to be a powerful deobstruent. At the head of these stands Mr Wallace, who found it, as he thought, exceedingly useful in chronic hepatitis in the form of gaseous bath, either with air alone, or with watery vapour,—and who has been successfully followed by Zeise of Altona and Julius of Hamburg (Mérat).——It is one of the numerous remedies that have been proposed for counteracting the poison of rabies; and, as in the case of every other alleged antidote for the

same purpose, respectable evidence has been brought forward in proof of its preventive virtues.——It is lastly employed as a disinfecting agent for destroying infectious effluvia, and putrescent emanations. It acts here by virtue of its power of disorganizing animal matters. It is obtained for this purpose either from chloride of lime and sulphuric acid, or from chloride of sodium, oxide of manganese, and sulphuric acid, as in the Dublin process for making Chlorine-water. Some remarks on its disinfecting power will be found under the head of chloride of lime (see *Calx chlorinata.*)

The doses of *Aqua chlorinei*, E. D. are fl.dr. ss. ad fl. dr. iv.

CINCHONA CORONÆ, *E. Bark of Cinchona Condaminea, Humb. et Bonpl. Plant. Æq.—Spr.—DC. Crown-Bark.*

CINCHONA CINEREA, *E. Bark of Cinchona micrantha, Ruiz and Pavon in Fl. Peruv.—DC. Gray-Bark. Silver-Bark.*

CINCHONA FLAVA. *E. D.* CINCHONA CORDIFOLIA, *L. Bark of an unascertained species of Cinchona* (Edin.); *of Cinchona cordifolia, Lambert's Cinchon.—Zea.* (Lond. Dub.) *Yellow-Bark.*

TESTS, *Edin.* A filtered decoction of one hundred grains in two fluidounces of distilled water gives, with a fluidounce of concentrated solution of carbonate of soda, a precipitate, which, when heated in the fluid, becomes a fused mass, weighing when cold two grains or more, and easily soluble in solution of oxalic acid.

CINCHONA LANCIFOLIA, *L.* CINCHONA OFFICINALIS, *D. Bark of Cinchona lancifolia, Lambert's Cinch. Zea. Pale-Bark.*

CINCHONA RUBRA, *E. D.* CINCHONA OBLONGIFOLIA, *L. Bark of an unascertained species of Cinchona, L. W. Spr.—DC.* (Edin.) *Bark of Cinchona oblongifolia, Lambert's Cinchon.* (Lond.) *Bark of Cinchona oblongifolia, Zea* (Dub.) *Red-Bark.*

DECOCTUM CINCHONÆ, E. D.

PROCESS, *Edin. Dub.* Take of
Crown, Gray, Yellow or Red cinchona, (Officinal cinchona, D.) bruised, an ounce;
Water, 24 fluidounces (a sufficiency, D.)
Boil for ten minutes, let the decoction cool, filter it, and evaporate to sixteen fluidounces (*Edin.*) Make a decoction, which, when filtered, shall be one pound by measure (*Dub.*)

DECOCTUM CINCHONÆ CORDIFOLIÆ, L.

PROCESS, *Lond.* Take of
Yellow-bark, bruised, ten drachms;
Distilled water, a pint.
Boil for ten minutes in a lightly covered vessel, and strain the decoction while it is hot.

DECOCTUM CINCHONÆ LANCIFOLIÆ, L.

DECOCTUM CINCHONÆ OBLONGIFOLIÆ, L.

PROCESS, *Lond.* To be prepared in the same manner from lance-leaved and oblong-leaved cinchona as the *Decoctum cinchonæ cordifoliæ.*

EXTRACTUM CINCHONÆ, E.

PROCESS, *Edin.* Take of any variety of Cinchona, but especially the Yellow or

Red cinchona, in fine powder, four ounces
Proof-spirit, twenty-four fluidounces.
Percolate the cinchona with the spirit; distil off the greater part of the spirit; and evaporate what remains in an open vessel over the vapour-bath to a due consistence.

Extractum Cinchonæ Lancifoliæ, L.
Extractum Cinchonæ, D.

Process, *Lond. Dub.* Take of
Bark of Cinchona lancifolia, bruised, fifteen (twelve D.) ounces;
Water, (distilled, L.) four gallons (six pounds, D.
Boil the bark in a gallon of water to six pints (Boil for fifteen minutes in a vessel nearly closed, D.); strain while hot through linen; repeat this with as much fresh water four (three D.) times. Evaporate the united liquors to the due consistence.

Extractum Cinchonæ Cordifoliæ, L.
Extractum Cinchonæ Oblongifoliæ, L.

Process, *Lond.* To be prepared in the same manner from heart-leaved and oblong-leaved cinchona as the *Extractum cinchonæ lancifoliæ.*

Infusum Cinchonæ, E. L. D.

Process, *Edin. Lond.* Take of any species of Cinchona according to prescription, in powder (of cinchona lancifolia, bruised, L.) an ounce;
Boiling (distilled, L.) water, one pint.
Infuse for four (six L.) hours in a covered vessel, and then strain through linen or calico.

Process, *Dub.* Take of
Cinchona lancifolia in coarse powder, an ounce;
Cold water, twelve fluidounces.
Triturate the bark with a little water, gradually adding the remainder. Macerate for twenty-four hours, shaking now and then; pour off the clear liquor.

Tinctura Cinchonæ, E. L. D.

Process, *Edin.* Take of
Yellow bark in fine powder, or of any other species of cinchona, according to prescription, eight ounces;
Proof-spirit, two pints.
Percolate the Bark with the spirit, the bark being previously moistened with a very little spirit, left thus for ten or twelve hours, and then firmly packed in the cylinder. This tincture may also be prepared, though much less expeditiously, and with much greater loss, by the usual process of digestion, the bark being in that case reduced to coarse powder only.

Process, *Lond. Dub.* Take of
Cinchona cordifolia, (lancifolia, D.) bruised, eight (four D.) ounces;
Proof-spirit, two pints (old wine measure, D.);
Macerate for fourteen (seven days) and strain.

Tinctura Cinchonæ Composita, E. L. D.

Process, *Edin. Lond. Dub.* Take of
Yellow-bark in coarse powder, but fine, if percolation be followed, four ounces, (of Cinchona lancifolia in coarse powder, four, L. two, D. ounces);
Bitter-orange-peel bruised, three ounces (Half an ounce, D.);
Serpentaria in moderately fine powder, six drachms;
Saffron chopped, two drachms;
Cochineal bruised, one drachm;
Proof-spirit, two pints, (Twenty fluidounces, D.)
Edin. Macerate for seven days; strain and express strongly: filter the liquors. This tincture may also be conveniently prepared by percolation as directed for compound tincture of cardamom.
Lond. Dub. Macerate for fourteen days and strain.

For. Names.—*Fren.* Quinquina.—*Ital.* China-china.—*Span.* and *Port.* Quina.—*Ger.* China.—*Dut.* China-bast.—*Swed.* Kina-bark; Kinkina-bark.—*Dan.* Kina; Kina-bark.—*Russ.* Chinaia korka.

Figures of Cinchona condaminea in Humb. Pl. Aeq. i. t. 10.—Hayne, vii. 37.—Nees von E. 260.—Steph. and Ch. iv. 183.—Cinchona micrantha in Fl. Peruv. ii. t. 194, and as Cinchona scrobiculata in Humb. Pl. Aeq. i. t. 47.—Nees von E. Suppl. 61.—Cinchona cordifolia in St. and Ch. iv. 185.—Hayne, vii. 40.—Cinchona lancifolia in Hayne, vii. 38.—Nees von E. 261.—Cinchona oblongi-

folia of Zea in Hayne, vii. 41.—Nees von E. 263.—Cinchona oblongifolia, Lambert, in Steph. and Ch. iv. 181—and as C. magnifolia in Fl. Peruv. ii. t. 196.

CINCHONA-BARK was first made known in Europe about the year 1640, in consequence of its having cured of a fever the lady of the Conde del Chinchon, at the time Vice-roy of Peru. Nothing positive is known of its earlier history, or how the Spaniards in Peru first became acquainted with its virtues. The commonly received tradition, which ascribes their acquaintance with it to the aboriginal inhabitants of Peru, is scarcely reconcilable with the fact, that both La Condamine in 1738, and Messrs Humboldt and Bonplandt sixty years later, found the natives, even around Loxa, the first known of the cinchona districts, unaware of its efficacy in the agues with which they were often afflicted. The first treatise on it was published in 1642 by Barba, a professor of Valladolid.

For some time after its introduction into Spain the Jesuits had the bark sent to them by their brethren in Peru, and kept the secret of its origin to themselves; but at the same time they did much to spread its fame as a febrifuge over Europe; whence it is still sometimes known in vernacular speech by the name of Jesuits' bark. It was at first vehemently opposed by the medical profession, till its cause was espoused by Dr Roland Sturm of Antwerp in 1659 and Sebastian Bado of Genoa in 1663. Not long afterwards the secret of the Jesuits was discovered by an Englishman of the name of Talbot; who, after practising in Essex, and then in London, settled at last in Paris; and there, after curing with his nostrum Louis the Fourteenth's minister Colbert, the Prince de Condé, the Dauphin, and many other persons of rank, he sold his secret about the year 1679 to the government for a sum of £1600, an annuity of £80, a ten years' monopoly, and the honour of knighthood. Its enormous price in his time, amounting to no less than five pounds sterling an ounce, is a decisive proof of the credit in which it was held. Subsequently to the divulging of the secret by the French king, its price soon fell; but its estimation has continued ever since with little and only temporary diminution.

Natural History.—The Botanical history of cinchona-bark is still imperfectly understood, and till a few years ago was wholly misrepresented. The jealousy of the Spaniards foiled for nearly a century the attempts of European botanists to investigate the subject. The first information supplied from America by an actual observer respecting the tree, and the mode of collecting the bark, appeared in the Philosophical Transactions for 1737, in a paper founded on intelligence from Dr Arrot, a Scotch physician in Peru. In the same year the philosopher La Condamine visited the cinchona country in the Peruvian province of Loxa; and the results of his observations, in which one species of tree is tolerably well described, were published in the Memoirs of the French Academy for 1738. A year afterwards Joseph de Jussieu also proceeded to

Peru, where he resided about thirty years, and ascertained more accurately the species which yields crown-bark. For many years subsequently it was not known that cinchona trees grew anywhere else than around Loxa. But in 1772, in consequence of some observations made by a Spanish gentleman, Don Miguel de Santistevan, while journeying from Loxa to Bogotà, the botanical traveller Mutis commenced, and afterwards in company with Zea completed, extensive researches in Columbia, and discovered several new barks and new species of cinchonas; the account of which was made public between 1792 and 1800. About the same period, and in the central parts of Lower Peru, Ruiz and Pavon conducted similar inquiries, which were begun in 1777, and published between 1792 and 1801. A few years later several of the cinchona districts were visited by Humboldt and Bonplandt, who made their observations known between 1807 and 1824. The only other investigations of any note made in America are those of Pöppig, carried on in Peru between 1827 and 1832, and published three years afterwards. No competent naturalist has yet visited the district of Upper Peru, whence the most esteemed variety of bark is obtained.

In Europe the subject has occupied the attention of many eminent botanists; and it has been illustrated in this country especially by Mr Lambert, first in 1797 and again in 1821, but above all by Professor Lindley in his Flora Medica in 1838. Of the investigations now specified, which are merely the most material of a far more extensive list, the ablest and most accurate are those conducted in America by Ruiz and Pavon, and by Pöppig, together with the critical inquiries of Professor Lindley, who has very clearly stated the exact amount of our present knowledge. It is impossible in the limits of this work to give a historical description of the progress gradually made in this very intricate and important inquiry. A few words however will be attempted, to show how it stands at the present moment.

Linnæus was the first to establish the genus *Cinchona*, which he named in honour of the Countess Chinchon. It belongs to the class and order *Pentandria Digynia* in his classification, and to the Natural family *Rubiaceæ* of Decandolle, and *Cinchonaceæ* of Lindley. It is distinguished from various allied genera by its five stamens being included within the tube of the corolla,—by the corolla being velvety or hairy,—by the persistent toothed calyx terminating the fruit,—and by the fruit consisting of two carpels, which when ripe separate from below upwards. Linnæus knew but one species, that of La Condamine; but many others were afterwards added till the genus became exceedingly extensive. It is still numerous; but recent botanists have correctly separated from it many plants formerly confounded with the true cinchonas; and Decandolle in his Prodromus has recognized no fewer than seven genera of these, among which the most important are *Exostemma*, comprehending several West-Indian plants,—*Remijia*, comprising three

Brazilian species described as cinchonas by Auguste St Hilaire,—*Buena*, including several Brazilian and Peruvian species,—*Pinckneya*, appropriated to a species in the southern United States, long considered there as a true cinchona,—and *Hymenodyction*, first adopted by Wallich for a species inhabiting the Circars of India, and described as a cinchona by Roxburgh. The two genera *Exostemma* and *Buena* (*Cosmibuena* of Ruiz) bear the most resemblance to the genus Cinchona; but they may be readily distinguished, the former by the stamens protruding beyond the tube of the corolla, and the latter by the fruit being destitute of a persistent calyx at its apex, and also opening when ripe from above downwards.

Soon after the commencement of the present century most Pharmacopœias, recognizing only three officinal barks, the pale, yellow, and red barks of commerce (*Cinchona pallida*, *flava*, and *rubra*), referred them, on the original authority of Mutis and Zea, to the species *Cinchona lancifolia*, *cordifolia*, and *oblongifolia* of these botanists. This view was confirmed in a great measure by the subsequent travels of Humboldt and Bonplandt; who also ascertained however, that the most highly prized of the pale-barks, distinguished in English trade by the name of crown-bark, is derived from a different species first described by La Condamine, and termed by Linnæus *Cinchona officinalis*. But as Linnæus's description was so general as to comprise more than a single species, they properly termed this one *C. Condaminea*. The critical labours of Mr Lambert at a period still more recent, also contributed to maintain the doctrines of Mutis and Zea; and in particular have secured them the recognition of the London College even in its Pharmacopœia of 1836. Nevertheless, not one of these references is exact. And the most authentic data, founded on the botanical contributions of Humboldt, of Ruiz, and of Pöppig, and tested by the critical acumen of Professor Lindley, as well as the pharmacological researches of Von Bergen in Germany, and Guibourt in France, seem to establish beyond a doubt, that we are at present absolutely ignorant of the true sources of the most esteemed commercial barks, the Yellow and the Red species; that the two finest varieties of the pale barks, called Crown bark and Silver or Huanuco-bark, are produced, the former by the *Cinchona Condaminea* of Humboldt, the latter by the *Cinchona micrantha* of Ruiz and Pavon; and that there are also other commercial kinds which are derived from a great variety of additional botanical species. Professor Lindley, the latest and ablest author who has written on the whole genus Cinchona, admits twenty-six species, of which no fewer than twelve are now thought to furnish a part of the barks of European commerce. These are eight species determined by Ruiz and Pavon, the *Cinchona micrantha*, *nitida*, *lucumæfolia*, *lanceolata*, *ovata*, *hirsuta*, *glandulifera*, and *magnifolia*, one determined by Vahl, the

Cinchona pubescens, one by Humboldt, the *C. Condaminea*, and two by Mutis, the *C. lancifolia* and *cordifolia*.

The whole species are either tall shrubs or considerable forest trees, commonly evergreen, and of great beauty both in foliage and in flower. In consequence of the incessant demand for their bark, they are now seldom seen of full stature. They are still unknown in the conservatories of Europe, partly on account of the difficult access to the country they inhabit, and partly because their seeds do not germinate unless put into the ground soon after they ripen.

The cinchona-trees are met with in the elevated valleys of the Andes at a height between 1200 and 10,000 feet above the sea, and along a meridional distance extending through Columbia, Peru, and Bolivia from the eleventh degree north to the twentieth degree south of the line. They produce the best bark on dry, rocky soil. The bark is collected from May till November by natives who pursue this occupation as their trade, and are therefore called Cascarilleros. The trees are sometimes cut down for the purpose; but often the bark is stripped from them as they grow, and the bare trees are left standing. The latter method however is detrimental, because new shoots do not spring up again; while, if the trunk be cut close to the ground, shoots speedily make their appearance, and become in their turn fit for felling in the course of from six to twenty years. The recklessness of the peelers has been repeatedly made the subject of complaint by naturalists; and the indiscriminate destruction of the trees, occasioned partly in this way, and partly by the increased demand for cinchona-bark for some time past in Europe, was at length felt to such a degree in Upper Peru, that in 1838 the Government issued an edict prohibiting the collection of bark for a period of five years. In stripping the trees, the whole bark, comprising the epidermis, rete-mucosum, cortex, and liber, is removed, but not the alburnum, as some suppose. The drying of the bark is commonly carried on, not in the woods where it is collected, but at the nearest inhabited spot; and great care is observed in the process, because the commercial value of the bark often depends not more on the brightness of its colour internally, than on its epidermis being uninjured and covered with the lichens which naturally abound on it. Sometimes however it is stripped of the epidermis, probably when that is coarse and thick so as to interfere with the process of drying; and this is practised chiefly with the larger barks, which are dried so as to form flat pieces. The others, being dried entire, curl inwards in the course of the process so as to constitute rolls or quills. The dried bark is conveyed subsequently to the coast for exportation, and is packed in chests, or in *serones* formed of hides and coarse cloth, in which it is brought from the mountains. The packages, which weigh from sixty to one hundred and fifty pounds, contain sometimes only one specie

of bark; but more commonly several sorts may be recognized in the same chest or seron.

For a long time Europe obtained its supply of bark chiefly from the neighbourhood of Loxa on the Peruvian frontier of Columbia in the fourth degree of north latitude. But since the beginning of the present century a large supply has also been sent from the vicinity of Bogotà, the capital of Columbia, from the forests of Huanuco in Lower Peru ten degrees south of the line, and from the neighbourhood of Apolobamba and La Paz in Bolivia or Upper Peru, between five and eight degrees still farther south. The chief ports for exportation are Valparaiso, Arica, Lima, Payta, Carthagena, and Buenos-Ayres. Britain, which supplies a considerable part of the continent of Europe, imports from 225,000 to 556,000 pounds annually, and retains towards 120,000 pounds for home consumption (Pereira).

In consequence of the extensive demand for cinchona-bark in European medicine and the great number of species in South America belonging or allied to the genus Cinchona, the varieties of bark, fine, inferior, or spurious, which may be met with occasionally in commerce, are almost interminable. The Pharmacography of the present subject is therefore equally complex with its botany; and, although investigated with great success by Von Bergen, by Guibourt, and by Dr Pereira, it is still in some respects unsettled and unsatisfactory. The division of the officinal kinds into Pale, Yellow, and Red Barks, though still adopted by the Colleges of London and Dublin in their Pharmacopœias, gives but a vague idea of the subject. Von Bergen has carefully characterized nine distinct kinds of true cinchona-barks, most of which are also distinguished in English commerce, namely China-Loxa, or crown-bark; China-Huanuco, or silver-bark; China regia, or yellow-bark; China-flava-dura, or hard-Carthagena-bark; China-flava-fibrosa, or woody-Carthagena-bark; China-Huamalies, or rusty-bark; China-Jaen, or ash-bark; and China-pseudo-loxa, an inferior crown or pale-bark, not distinguished in Britain from the last kind. M. Guibourt has endeavoured to determine no less than thirty-seven different kinds, which he classifies in five divisions, namely Gray, Yellow, Red, White, and Spurious barks. Dr Pereira, after carefully comparing the cinchonas of the London market with a set of specimens from von Bergen named according to that author's arrangement, and another from Guibourt arranged according to the nomenclature of that pharmacologist,—distinguishes thirteen true and five spurious barks. The former he classifies in two sections, according as their epidermis is brown or white; and each section consists of three groups, according as the substance of the bark is comparatively pale, yellow, or red. His species are I. 1. Crown-bark, Silver or Huanuco-bark, Ash-bark, Rusty-bark; I. 2. Royal-yellow-bark; I. 3. Red-bark. II. 1. White-Loxa-bark; II. 2. Hard Carthagena-bark, Fibrous-Car-

thagena-bark, Cuzco-bark, Orange-bark of Santa-Fé; II. 3. Red-bark of Santa-Fé, and another red bark of unknown origin with a micaceous epidermis, which is sometimes mixed with true red-bark. The spurious barks are St Lucie, Caribean, False-Peruvian, False-Brazil, and Pitaya Bark. From a comparison of the descriptions of von Bergen, Guibourt, and Dr Pereira with a complete set of specimens which I owe to the kindness of M. Guibourt, with those in the Martius' collection of the Edinburgh College of Physicians, and with numerous barks obtained from various wholesale druggists in London,—and likewise from inquiries made there personally some years before the appearance of Dr Pereira's work on Materia Medica,—I have no doubt of the accuracy and convenience of that author's arrangement.

All true Cinchona-barks however are not officinal. Some are so low in quality, though genuine as to kind, that they cannot be advantageously used, either for making the galenical preparations of the druggist, or by the manufacturing chemist for obtaining the active principles of cinchona. These ought therefore to be excluded from the Pharmacopœias. The Edinburgh College, with a view to this object, has recognized only four species, Crown, Silver, Yellow, and Red Bark. A fifth, called Pale-bark, an old vague term applied in commerce to inferior barks, was admitted into the first English Pharmacopœia of 1839, but has been properly excluded from the later edition.——In what follows a full description will be given of the four officinal species; and then a shorter account of the other genuine barks, from the genus Cinchona. The spurious barks will be considered under the head of Adulterations.

1. Crown-bark,—Cascarilla fina de Uritusinga of the Spaniards, China-Loxa or Kron-China of von Bergen, Quinquina de Loxa of Guibourt, and *Cinchona coronæ* of the Edinburgh Pharmacopœia,—was probably the first kind accurately known in Europe; for there are descriptions so early as 1694, which apply to this species as now met with in commerce. The tree which produces it was described in 1738 by La Condamine as the source of his Corteza de Loxa; and this is, by consent of all late authorities, the *Cinchona Condaminea* of Humboldt and Bonplandt. The Edinburgh College adopts this reference. The London and Dublin Colleges must have intended to recognize the same bark; but by adopting the reference to *C. lancifolia* of Mutis, they have really acknowledged an inferior bark, seldom seen in European commerce, the Orange-bark of Bogotà. M. Guibourt has been enabled to correct this error by an examination of authentic specimens named by Mutis himself, and deposited by Humboldt in the Botanical Museum of the Jardin des Plantes at Paris. I have been favoured by Professor Adolphe Brongniart with a portion of these interesting specimens, which convince me of the accuracy of M. Guibourt's investigations, and render it extraordinary that the error he has

rectified should ever have been committed.—The crown-bark tree inhabits the woods round Loxa in the south-western angle of Columbia, and also the adjacent Peruvian territories. The bark is imported in chests and serons. It consists entirely of quills, simple or double, straight or nearly so, from six to fifteen inches long, varying in diameter from the size of a crow-quill to that of the thumb or somewhat larger, and in thickness from a thirtieth to a sixth of an inch. The epidermis is always entire. The external surface is crowded with fine longitudinal furrows, and crossed with transverse fissures except in the finest quills; it presents various tints of gray, inclining sometimes to liver-brown; and it is generally covered irregularly with minute white lichens, which give it here and there the appearance of silver filagree. Some have suggested that good characters for distinguishing this and other kinds of cinchona-bark from one another may be deduced from the species of lichens on each. This is doubtful; and such a test is besides too refined for practical use. The inner surface and the powder of crown-bark have a cinnamon-brown colour. It has a bitter, rather acid, somewhat aromatic, astringent taste, and a faint, peculiar, aromatic odour, especially when moistened with hot water. It is on the whole an unmixed bark; but fine quills of Rusty-bark, sometimes called Rusty Crown-bark, are not uncommon in its packages.—It has been always in high estimation; till 1776 no other kind was in use in Europe; and it is still preferred to the rest by the London and Dublin Colleges for making the galenical preparations of their Pharmacopœias. The finest quills are the most prized by many; but those of middle size are really the best.

2. GRAY-BARK, Silver-bark, or Huanuco-bark,—the Cascarilla provinziana of the Spaniards, China-Huanuco, or Graue-China of Von Bergen, Quinquina de Lima of Guibourt, and *Cinchona cinerea* of the Edinburgh Pharmacopœia,—is another of the pale-barks, of much more recent introduction into Europe than the former. It has been known in commerce only for fifty-five years; and since 1815 it has been little met with in Europe till lately, in consequence of collectors and merchants having neglected to attend sufficiently to its genuineness and quality. It is obtained from around Huanuco in Peru on the upper part of the Huallaga, a considerable tributary of the river Amazons; and it is exported chiefly from Lima. The species that yields it has been lately determined by Pöppig to be the *Cinchona micrantha* of Ruiz and Pavon, or *C. scrobiculata* of Humboldt and Bouplandt. This bark occurs always in quills, with the epidermis. The quills are between a sixth of an inch and two inches in diameter, and on the whole larger than those of crown-bark,—between a thirtieth of an inch and a quarter of an inch in thickness,—less furrowed longitudinally than crown-bark, and with fewer transverse fissures,—more uniformly grayish-white on the outer surface, especially in the finer pieces, and rather redder on the inner surface,—and in its fracture closer and more resinous-

like. A character peculiar to it is, that the edges of perfect quills are cut obliquely. The powder has nearly the same shade of cinnamon-brown with that of crown-bark, and is almost identical in odour and taste, except that it is more bitter if of fine quality.—It is a very superior kind of cinchona-bark; but, for reasons already adverted to, it is less known and less esteemed than it ought to be. It is mixed in the packages with Ash-bark and the finer quills of Rusty-bark, which are greatly inferior.

3. Yellow-bark,—the Cascarilla calisaya, or more correctly Colli-salla (Pöppig), of the Spaniards, Quina regia or König's-China of Von Bergen, Quinquina jaune royal of Guibourt, and *Cinchona flava* of the Edinburgh and Dublin Pharmacopœias,—is possibly one of the kinds mentioned by Arrot in 1737, and seems to have been alluded to even by Pomet towards the close of the preceding century; but it was not distinctly known in Europe till 1789. The botanical species which produces this bark is still undetermined. The reference of the London and Dublin Pharmacopœias is altogether erroneous. The bark of *Cinchona cordifolia* of Mutis and Zea, believed by these botanists, by Humboldt and Bonplandt, and by Lambert, to be the yellow-bark of commerce, has been ascertained both by the researches of Von Bergen, and more especially by an examination of specimens of Mutis' own barks made by M. Guibourt, to be the Hard-Carthagena-bark of English druggists,—an inferior sort produced in Columbia among the mountains around Bogotà. I am able to confirm this conclusion, from specimens named by Mutis which I have received from Pr. Ad. Brongniart with those formerly mentioned. True yellow-bark is exported from Arica, a port of Bolivia, either directly or through the medium of Lima; and according to the latest information it is produced around Apolobamba on the Rio Para, a principal branch of the Amazons, in the 15th degree of south latitude, and 1200 miles south of Bogotà (Cochet), or near La Paz three degrees farther south, near the sources of the same stream (Delondre, Pereira). It is unnecessary to notice here the more recent opinions as to the botanical source of this bark, because they are merely conjectural. Yellow-bark is imported both in chests and serons. It is composed, partly of quills, partly of flat pieces.—The quills, called in Peru Calisaya arolada, are generally from nine to fifteen inches long, from one to two inches in diameter, and from an eighth to a third of an inch in thickness. A few however are considerably smaller and thinner, but fine quills are never seen like those which form a considerable proportion of crown-bark and gray-bark. They are generally single, and clothed with the epidermis. They are for the most part very rough externally, being much traversed by longitudinal wrinkles and transverse fissures; and their colour is grayish-brown mottled with large grayish-white patches from adhering lichens. The inner surface is smooth, longitudinally fibrous, clean, and of a yellower cinnamon-brown than the two previous

barks. The transverse fracture is close, but fibrous and splintery; and the fibres break under trituration into minute sharp spiculæ, which irritate the skin. The taste and odour are as in crown-bark, but stronger.—The flat pieces, or Calisaya plancha of the Peruvians, sometimes retain their epidermis, but are more generally stripped. Both present all the characters of the quilled variety, except that the stripped pieces have externally the cinnamon-brown colour of their inner surface, and are free of cracks and wrinkles. They are from eight to eighteen inches long, between a line and half an inch in thickness, and from one to four inches in breadth. Some pieces in my possession are evidently taken from branches of considerable size.—Yellow-bark has been much prized since the beginning of the present century; and has risen in estimation since sulphate of quina came into general demand, because it yields much more of that salt than is obtained from any other kind of cinchona-bark. The finest pieces are those of middle-size, dense, and close in texture. At one time quills were preferred to flat pieces; but it is now considered as settled by chemical analysis that good flat bark is the best of all. I have sometimes however been led to doubt the universality of this fact. Its external characters are so distinct, that other barks cannot be easily mingled with it; but the two Carthagena-barks, also Cuzco-bark, and Orange-bark, are sometimes substituted.

4. Red-Bark,—the Cascarilla colorada of the Spaniards, China rubra or Rothe-China of Von Bergen, Quinquina rouge of Guibourt, and *Cinchona rubra* of the Edinburgh and Dublin Pharmacopœias,—seems to have been one of the varieties mentioned between 1737 and 1751 by Arrot, La Condamine, and Jussieu; but it was unknown, or at least not distinguished in English commerce till after 1779, when a cargo of it was captured by an English frigate, and tried in England as a new variety. The present commercial source of it is not well ascertained; but the captured vessel came from Lima. Its botanical source is wholly unknown. The Dublin College indeed refers it, on the authority of Mutis and Zea, to the *Cinchona oblongifolia* of these authors; and the London College, apparently confounding with this species a very different one, the *C. oblongifolia* of Lambert, virtually adopts the same reference. But this is an error, arising from the Spanish botanists having mistaken for the red bark of European commerce the Quina roxa (red), or Quina Azahar, of Santa-Fé de Bogotà,—a variety which Guibourt, by means of the specimens from Mutis in the collection of the Jardin des Plantes, has been enabled to identify with a very inferior kind imported from Carthagena, the Cinchona-nova of the continental markets. To M. Ad. Brongniart I am here again indebted for specimens named by Mutis, which leave no doubt of the soundness of M. Guibourt's conclusions.—Red-bark comes to this country always in chests. It consists of quilled and flat pieces. The flat pieces, which are the more common of the two,

are seldom absolutely flat, but rather form portions of cylinders. They are from two inches to two feet in length, from one to five inches in breadth, and from one-quarter to three-quarters of an inch in thickness. They are generally covered with the epidermis, which is rough, wrinkled, often warty, little fissured, of a reddish-brown colour, and with a grayish efflorescence in the hollows from adhering lichens. The inner surface is coarsely fibrous and deep cinnamon-brown, inclining to reddish-brown; and the powder has a redder tint than any of the preceding sorts. The taste is very bitter, somewhat aromatic, and more astringent than the other officinal barks.—Quilled red-bark occurs in pieces about the same size as quilled yellow bark. They have externally a paler reddish-brown tint than the flat pieces, sometimes a grayish-brown hue, with frequent patches of paler gray lichenous efflorescence, few transverse fissures, a closer and less fibrous fracture, and a clearer cinnamon-brown colour in their substance, approaching occasionally to that of yellow-bark.—Red-bark has been always highly esteemed since it became thoroughly known; and it has been sometimes preferred to all other sorts of cinchona. Partly on this account, and partly because it is scarce in Europe, it has long brought, and still brings, the highest price of all in the market. It is in fact now seldom seen genuine. It has been confounded with the larger pieces of Rusty-bark, and on the continent with the bark called there Cinchona-nova. But its characters are such as to render its discrimination from these inferior kinds a very simple matter.

Such are the several kinds of Cinchona Bark hitherto ascertained to be of fine quality. The inferior, yet still genuine, sorts worthy of mention are as follows.

5. Ash-bark,—the Cascarilla pallida of Ruiz, the China Jaën of Von Bergen, and Quinquina de Loxa cendré of Guibourt is one of the pale barks of English trade at times confounded with Crown-bark. Its commercial and botanical sources are uncertain. Von Bergen states that it is identical with the cascarilla pallida of Ruiz's collection, known on Ruiz's authority to be produced by the *Cinchona ovata*, Fl. Peruv. This species grows not far from the Huanuco district; but the German name of the bark would rather imply that it comes from the Columbian town of Jaën de Bracomoras, five degrees farther north. In European commerce it occurs only in quills, about the size of those of crown-bark, but easily distinguished by being almost all somewhat curved,—by the outer surface presenting few transverse fissures or longitudinal furrows, and by their bitterness and astringency being comparatively feeble. It is a bark of low quality, chiefly used for adulterating crown-bark.—Von Bergen has distinguished as a separate species, under the name of China Pseudo-Loxa, or dark Jaën-China, a variety of this bark, the commercial source of which is doubtful, but which he found to correspond exactly with barks in Ruiz's collection, marked by that botanist as produced by *Cinchona nitida* and *C. lanceolata*. It is not distinguished in British

trade; and Guibourt thinks it nothing else than an inferior Crown-bark. Von Bergen found it to correspond also with the bark of Mutis' *C. lancifolia*, which Professor Lindley shows to be widely different from *C. nitida*, and *C. lanceolata*, of Ruiz. I owe to the kindness of Professor Jameson of Quito a specimen of bark, produced in abundance around Azogues, which corresponds with the characters of Von Bergen's Pseudo-Loxa bark. Although it bears a close resemblance to good crown-bark, it is quite worthless, as its feebly bitter taste at once demonstrates.

6. Rusty-bark,—the Cascarilla boba colorada of the Spaniards, the China Huamalies of Von Bergen, and the Quinquina ferrugineux or Huamalies of Guibourt,—is not used in this country as a distinct bark. It comes from Lima, and has been traced through the inquiries of Pöppig to the *Cinchona pubescens* of Vahl, or *Cinchona purpurea* of Ruiz and Pavon, a species which seems to be rather extensively diffused throughout the Andes of Peru and Columbia. There are several varieties of it. One which occurs both quilled and flat, has a uniform rusty outer surface, sometimes warty, and entirely without transverse fissures. Another, described by Dr Pereira, resembles closely the finer quills of crown-bark, but has altogether a smoother appearance, presents "fewer transverse cracks, and is nearly white in its interior." Another, in larger quills, and often mixed with crown-bark, has a grayish-epidermis easily detachable with the nail. The varying appearances of this species depend apparently on the age of the branch from which the bark has been taken. It is little esteemed, and in Britain is purchased only for the German market (Pereira).

7. The White-Loxa-bark of Dr Pereira, the Quinquina blanc de Loxa of Guibourt, seems to differ little from the finer quills of rusty-bark, except that it is covered with a whitish epidermis. Nothing is known of its commercial or botanical sources, farther than that it is met with in packages of crown-bark; with which it is apt to be confounded.

8. Hard-Carthagena-bark,—the China flava dura of Von Bergen, and Quinquina de Carthagéne jaune of Guibourt, is the Quina amarilla or yellow-bark of Mutis, and is undoubtedly produced by the *Cinchona cordifolia* of that author, an inhabitant of the forests of New Granada near its capital, Bogotà, and erroneously supposed to produce the true yellow-bark of European commerce (See Yellow-bark, p. 321.) It is imported from Carthagena. It occurs both quilled and flat, but chiefly in the former state, or in sections of cylinders. It is easily known from true yellow-bark, with which it has been sometimes confounded, by having scarcely any transverse fissures, and by presenting everywhere, unless at the places where it has been rubbed, a uniform, velvety, grayish-white or pale yellowish-white, glistening epidermis, the colour of which is essential and not dependent upon lichens, like the gray appearance of the first four species of bark. Its fracture is splintery. Its powder

resembles that of yellow-bark, but its taste is by no means so strongly bitter.—This kind is very inferior to good qualities of the officinal cinchonas, and is scarcely ever used alone in Britain.

9. WOODY (or Fibrous), CARTHAGENA-BARK, the China flava fibrosa of Von Bergen, and Quinquina de Colombie ligneux of Guibourt, is introduced into Europe along with the last variety from Carthagena. Its botanical source, though probably the same, is not positively known. It occurs quilled or flat. Its epidermis is generally wanting in part or altogether; its substance is paler yellow than in the other variety; its fracture is more fibrous; and its taste is more feebly bitter and slowly developed. In other respects it scarcely differs from Hard-Carthagena bark; and, like that species, it is held in low estimation.

10. CUZCO-BARK is a new species, first described in 1830 under this name by M. Guibourt, and believed by him to be identical with the Arica-bark examined chemically about the same time by Pelletier. It comes from Cuzco, in the southern parts of Lower Peru, and is exported from Arequipa; but its botanical source is unascertained. It has been usually thought identical with the *China rubiginosa* of Von Bergen; and at one time Winckler held it to be nothing else than a sort of Hard-Carthagena-bark. But the latter authority now describes it as a perfectly distinct species, in short half-rolled quills, or pieces almost flat, sometimes stripped, sometimes covered with the epidermis. The outside is even, or presents shallow pits, or warts, or more seldom longitudinal fissures; and its colour is silver-white or gray, with coffee-brown spots where frayed. It breaks easily across, and is easily crushed between the teeth. This bark is almost undistinguishable from some Hard-Carthagena-barks, by ordinary external characters. Holl, however, says it may at once be known by its transverse fracture showing before a magnifier grayish-black, horn-like spots, on a deep-reddish ground, and with a white centre. And according to the analysis both of Pelletier and of Winckler, its active principle is different from those contained in all other true barks. It is probably one of the best of the secondary barks. It seldom occurs in English trade.—The China Rubiginosa of Von Bergen, often confounded with Cuzco-bark, is of doubtful origin. Its external characters are much the same with those of Cuzco-bark; yet it must be different, if, as Winckler found, it contains only one of the ordinary alkaloids, common to the other cinchonas. It is a superior kind of secondary bark; and the analysis of Winckler even makes it one of the very best of the finer barks. On the whole, however, it may be strongly suspected that mistakes have been committed in characterizing this species, and that other barks have been sometimes analysed instead of it.

11. The ORANGE-BARK of Santa-Fe is another species lately defined by M. Guibourt under the name of Quinquina de Carthagène spongieux, and identified by him with the Quina naranjada

of Mutis. Dr Pereira has seen it only once in English trade under the name of New Spurious yellow-bark. It is collected in the woods round Bogotà, and is produced by the *Cinchona lancifolia* of Mutis (*C. angustifolia,* Pavon,) long erroneously supposed in Europe to produce crown-bark (See p. 319.) It resembles yellow-bark. It occurs in quills of all sizes, or in portions of cylinders sometimes five inches broad. It is distinguished by the orange colour of its substance, and by the epidermis presenting, where present, a velvety, pale, grayish-white, glistening surface. It is spongy, feebly bitter, of little value, and rarely seen in the European market. It seems to have been first made known by Mutis, who thought it a yellow-bark of fine quality. But his store of it was condemned and destroyed by the Spanish authorities in Peru;—an act of discrimination for which they were afterwards severely, though erroneously, assailed by Humboldt.

12. The RED-BARK of SANTA-FE, conveniently so called by Dr Pereira, is the Quinquina nova of Guibourt, by whom it has been identified with Mutis's Quina roxa or Azahar de Santa-Fé, the produce of this author's *Cinchona oblongifolia,* the *C. magnifolia* of Ruiz and Pavon (See Red-bark, p. 322). It is widely different in appearance from every other true cinchona-bark, and has no resemblance whatever to the true red-bark of European commerce, which has been referred by the London and Dublin Colleges, on the authority of Mutis, to this species. It is a rare kind in English commerce, but has been used at times for adulterating the powders of other sorts (Pereira). There is a specimen in my predecessor Dr Duncan's collection under the name of Gibraltar-bark, which corresponds with the cinchona-nova of French commerce presented to me by M. Guibourt, and with the red-bark of Mutis from that traveller's own specimens. The Red-bark of Santa-Fé is quilled when small and cylindrical, but open or flat when large. Its epidermis is whitish, thin, uniform, with a very few transverse rents, apparently caused by desiccation. It is reddish-brown where stripped of the epidermis, and in its substance pale flesh-red, becoming slowly reddish-brown under exposure to the air. It has a flat astringent taste, with little bitterness. It scarcely deserves to rank among the febrifuge cinchona-barks at all; and by Guibourt indeed has been arranged with the spurious barks.

13. The same pharmacologist describes in the last edition of his Histoire des Drogues, several other species allied to the red-barks of commerce, one of which only is occasionally seen in English trade (Pereira). This is the Quinquina rouge à épiderme blanc et micacé of the former author. It is a thick bark, with a soft, velvety, white, glistening epidermis, and is sometimes dense and very bitter, at other times spongy, and almost without taste. Its origin is unknown; and it is valueless.

Chemical History.—The chemistry of cinchona-bark is more interesting perhaps than that of any other article of the vegetable

Materia Medica. The first glimpse of its intimate nature was obtained in 1803 by Dr Duncan; who inferred from the effects of reagents on its infusions, that it contains a peculiar principle capable of forming precipitates with tannin. In 1810, Gomez of Libson, in express continuation of Duncan's researches, obtained a crystalline substance possessing substantially the properties that attracted the notice of his precursor. These observations paved the way for the great discoveries of Pelletier and Caventou in 1820; who ascertained that the principle of Gomez is a febrifuge alkaloid, for which they retained the name of Cinchonia, first used by Duncan, —that cinchona-bark also contains another alkaloid, even more powerfully febrifuge, which they termed Quina,—and that there exist also in it a peculiar acid, the Cinchonic acid, a variety of tannin, two peculiar colouring matters, called Cinchonic-red and Cinchonic-yellow, which perform an important part in certain chemical relations of the bark,—together with a green concrete oil, starch, gum, ligneous fibre, calcareous salts, and a trace of volatile oil. In 1829, Pelletier and Corriol added to these discoveries a third alkaloid, Aricina, which they obtained from Cuzco-bark; and in 1842 Manzini announced that he had found a fourth alkaloid, which he called cinchovatina, in the Ash-bark, or Pale Jaen bark of Von Bergen. It will be necessary to take here some notice of the more important proximate principles of the true cinchonas before proceeding to the other chemical and pharmaceutic relations of the crude drug.

Cinchonia is best obtained from Gray-bark, or, failing this, from red-bark or hard Carthagena bark, either by the process recommended in the Edinburgh Pharmacopœia for preparing sulphate of quina, or by the method of Henri for the same purpose,—both of which processes are detailed under the article *Quinæ sulphas*. A sulphate of cinchonia being thus formed, its alkaloid may be separated by decomposing a watery solution of the sulphate with an alkali, and crystallizing the precipitate from a strong solution of it in boiling rectified spirit. It is prepared by some English manufacturers in considerable quantity as a collateral product in their process for sulphate of quina.—Cinchonia readily crystallizes in colourless four-sided prisms. It is tasteless or very feebly bitter, but becomes more bitter when dissolved. Heat fuses it, and begins to decompose it, disengaging ammonia. It is almost insoluble in water, rather soluble in boiling rectified spirit and in ether, sparingly so in cold spirit, fixed oils, or volatile oils, but freely in acids. It neutralizes acids, forming with them crystallizable and commonly soluble salts. It exists in cinchona-bark in the form of cinchonate. Its disulphate readily crystallizes in four-sided prisms; and the solution of this salt in water gives a white precipitate of cinchonia with alkalis, a grayish-white precipitate of tannate of cinchonia with infusion of galls, and a red solution with chlorine fol-

lowed by ammonia. Cinchonia consists of 20 equivalents of carbon, 12 hydrogen, 1 oxygen, and 1 azote ($C^{20}H^{12}ON$).

QUINA is best prepared from true yellow-bark by the process described under the articles *Quina* and *Quinæ sulphas.* Its properties are particularly described in the former of these articles. It is distinguished from cinchonia by being a powder or in delicate needles, intensely bitter, more easily fusible, and more soluble in alcohol and rectified spirit; and its disulphate crystallizes in filiform needles, and forms a watery solution, which becomes, not red, but emerald-green when treated with chlorine and afterwards with ammonia. It is composed of 20 equivalents of carbon, 12 hydrogen, 2 oxygen, and 1 azote ($C^{20}H^{12}O^{2}N$.)

ARICINA, or cuzconia, the third alkaloid, scarcely requires any notice here. It approaches cinchonia in properties, but is rendered green by nitric acid, and consists of one equivalent more of oxygen than quina. M. Guibourt says he could obtain no other alkaloid than cinchonia from Cuzco-bark; which he considers to be what Pelletier and Corriol analyzed when they obtained their supposed aricina. But this discrepancy of result is intelligible, if Winckler be right in maintaining that Cuzco-bark and von Bergen's China-Rubiginosa, usually confounded together, are distinct barks, the one containing cuzconia alone, and the other cinchonia.—Another alkaloid, not long ago indicated as contained in some barks, and called Chinoïdina, has been proved to be merely an impure uncrystallizible quina.

CINCHONIC, or kinic, ACID is soluble, with difficulty crystallizable, not volatile, but convertible by a distilling temperature into a new acid, the pyro-kinic acid. In other respects it resembles acetic acid in its habitudes, and more especially in forming soluble salts with lime, oxide of silver, and oxide of lead. In the bark, it exists in union with the alkaloids and with lime. Another acid, called Kinovic acid, has been found by Pelletier and Caventou in the Red-bark of Santa-Fé. This seems identical with the Chinova-bitter of Winckler, found by him in many kinds of bark, but especially in Rusty-bark, Cuzco-bark, the several varieties of Cinchona-nova, and above all in two spurious kinds called Piton and Caribean bark. It is amorphous, friable, snow-white, very bitter, acid in its reactions, and easily soluble in water.——The TANNIN of cinchona-bark resembles that of catechu in producing dark-green precipitates with salts of iron. It is the cause of the precipitates occasioned in infusions of cinchona by tartar-emetic, gelatin, and ferruginous salts. It absorbs oxygen rapidly, and thereby becomes cinchonic-red.——CINCHONIC-RED is a brownish-red amorphous substance, sparingly soluble in water or ether, and easily soluble in alcohol, in solutions of alkalis or their carbonates, or in acidulated water. It is thrown down from its solutions by tartar-emetic, but not by gelatin. It is an important pharmaceutic fact, that this principle unites with the alkaloids quina and cinchonia, forming

brownish-red compounds, very little soluble in cold water, more so at 212°, soluble in rectified spirit or weak acids, and decomposable by the alkalis.——CINCHONIC-YELLOW is soluble in water, alcohol, and ether, and is not thrown down from its solutions by tartar-emetic.——The other ingredients of cinchona-bark do not require particular notice.

The proportion of these several principles differ in different barks. Repeated attempts have been made to determine their relative amount; but the results are so discrepant as to make it scarcely possible, that the same kinds of bark have been examined by different experimentalists. The following table presents the proportion of the two alkaloids in a thousand parts of the chief barks of commerce, according to the analyses of various esteemed authorities. The results of Von Santen are calculated from data given by Von Bergen in his *Monographie der China*, and on the presumption that the pound used was the civil-pound of 7680 Nuremberg grains. Those of Soubeiran are calculated from the data in the late edition of his *Traité de Pharmacie*, and upon the supposition that the pound, to which his own numbers refer, was the metrical pound of 9414 grains Poids-de-Marc. Those of Michaëlis are taken from Geiger's Pharmacie; those of Goebel I have calculated from his data quoted by Dr Pereira; and those of Winckler are calculated from the proportions assigned by him as contained in 16 Hessian ounces, or 7680 grains.

		Crown-Bark	
		Cinch.	*Quin.*
Von Santen	*Fine quills*	0.0	0.5
Soubeiran	*Fine quality*	12.3	trace
Michaëlis	*do.*	2.4	1.0
Goebel	*do.*	2.6	2.0
Von Santen	*Medium quills*	0.0	2.1
Winckler	*do.*	3.0	4.3
Soubeiran	*Low quality*	9.2	0.0

		Gray-Bark	
		Cinch.	*Quin.*
Von Santen	*Fine quills*	24.33	0.0
Do.	*Medium quills*	27.3	0.0
Winckler	*do.*	24.7	0 0
Soubeiran	*Fine quality*	9.2	0.0
Michaëlis	*do.*	10.0	3.6
Goebel	*do.*	21.3	0.0
Michaëlis	*Inferior*	6.4	4.2

		Yellow-Bark	
		Cinch.	*Quin.*
Von Santen	*Stripped quills*	0.0	15.0
Do.	*Stripped flat*	0.0	14.6
Soubeiran	*Quilled*	0.0	17.2
Michaëlis	*do.*	0.0	20.0
Goebel	*do.*	0.0	11.0
Soubeiran	*Flat*	0.0	21.3
Michaëlis	*do.*	0.0	37.0
Goebel	*do.*	0.0	12.3
Winckler	*do.*	0.0	21.4

		Red-Bark	
		Cinch.	*Quin.*
Von Santen	*Thick quills*	24.0	0.8
Soubeiran	*Fine quality*	6.1	11.5
Michaëlis	*do.*	4.2	8.3
Goebel	*do.*	8.4	5.2
Soubeiran	*Pale red*	6.1	8.6
Von Santen	*Fine quills*	9.0	7.5
Do.	*Flat*	11.8	1.5
Winckler	*do. dark*	23.2	1.1
Do.	*do. pale*	10.5	0.8

		Carthagena-B.	
		Cinch.	*Quin.*
Von Santen	*Hard C.*	4.0	3.2
Goebel	*do.*	5.5	7.3
Winckler	*do.*	2.1	0.3
Von Santen	*Woody C.*	4.4	3.0
Goebel	*do.*	7.0	5.4
Winckler	*do.*	10.6	0.0
Do.	*Yellow Cuzco*	16.4	16.4

	Ash-Bark		*Rusty-Bark*	
	Cinch.	*Quin.*	*Cinch.*	*Quin.*
Von Santen	0.0	trace	12.4	0.0
Goebel	1.6	1.2	5.1	3.6
Michaëlis	1.6	10.4	6.3	3.6
Do. thin quills	—	—	0.0	1.0
Winckler	0.0	3.7	1.0	0.0
Do. thin quills	—	—	1.1	0.1
Do. thick quills	—	—	8.6	3.0

	China rubiginosa.		*Dark Jaen B.*	
Winckler	33.3	0.0	0.3	0.7

Mere differences in the quality of the bark or even in the mode of manipulating cannot account for such discrepancies, not in quantity only, but also in the nature of the alkaloids in crown, gray, red, and rusty bark. The quality however even of well chosen samples does seem to differ much, so far as concerns the proportion of alkaloids. An English manufacturer informs me that 100 pounds avoirdupois of good yellow-bark yield him sometimes 50, sometimes only 25 ounces of sulphate of quina, that is from 31.25 to 15.6 parts in one thousand, or from 23.4 to 11.7 of quina. According to all the results in the table, yellow-bark does not contain any cinchonia. But the same gentleman states that his operations yield enough to be worth preserving; and I have a fine specimen of cinchonia from this source. In some too of Von Santen's analyses not given in the table a little cinchonia was separated.——The proportion of the other principles of cinchona-bark is unimportant in relation to pharmacy or therapeutics. Red-bark appears to contain most tannin and cinchonic-red. Crown-bark contains nearly five per cent of tannin (Pucholz). Gum is said not to exist in red or yellow-bark. True cuzco-bark contains in a thousand grains 14.0 of aricina and 17.5 of chinova-bitter. The Red Cinchona-nova contains 34 grains of Chinova-bitter, and no alkaloid.

The different kinds of cinchona-bark yield their active constituents to water, rectified spirit, proof-spirit, and diluted acids. These solvents are accordingly much used for making both the galenical and chemical preparations of the Pharmacopœias.

Cold-water is not an active solvent; but boiling-water acts more readily. When the latter is used in the way of infusion, it does not easily exhaust the bark; yet a convenient preparation is thus obtained, the *Infusum cinchonæ* of the Pharmacopœias, which was a good deal in use before the introduction of sulphate of quina into practice.—When water is boiled with bark in coarse powder, it accomplishes exhaustion, and a reddish liquid is obtained, which becomes paler and yellowish on cooling, and deposites a red powder. The Colleges have each a *Decoctum cinchonæ*, which, like the infusion, was in general use not long ago. This however is not an eligible preparation. For, under the influence of prolonged heat, the cinchonic-red unites with the alkaloids, and compounds result, which are sparingly soluble in hot water, and still less soluble at atmospheric temperatures; so that the active constituents are thrown partly down insoluble as the decoction cools or concentrates, and consequently form part of the red powder already mentioned. Both the decoction and the infusion therefore would be much improved by acidulating the water with muriatic or sulphuric acid, which retains the alkaloids in solution.——For the reason just adverted to the *Extractum cinchonæ* of the London and Dublin Pharmacopœias, prepared, as it is, by evaporating a watery decoction, is far from being a correct preparation. In fact not above one-half of it is again soluble in water (Duncan). It is much

improved in bitterness and aroma if prepared by evaporation in vacuo; yet even then water dissolves it but partially. An inferior extract is sometimes imported from America, which Von Santen found not to contain either alkaloid. I owe to M. Guibourt a resinous-like extract, which is said to be an inspissated juice from Buenos-Ayres, and which, from its want of aroma, and sparing solubility in water, seems also of low quality.

Proof-spirit is a much better solvent than water, and is therefore used for preparing officinal tinctures. It dissolves the alkaloidal salts in the bark completely, and also the tannin, cinchonic-red, cinchonic-yellow, and the compounds of cinchonic-red with cinchonia and quina. It acts easily at atmospheric temperatures. Exhaustion is accomplished with it more readily by percolation than by maceration. In the former way, provided the bark be in moderately fine powder, the spirit directed by the Edinburgh College for making the *Tinctura cinchonæ*, amounting to about four times the weight of the bark, leaves scarcely any alkaloid in the refuse. The tincture yields a very superior extract to that obtained from the watery decoction, and is therefore correctly preferred for making the Edinburgh *Extractum cinchonæ*. The *Tinctura cinchonæ composita*, also made with proof-spirit, is equivalent to the preparation commonly called Huxham's tincture of bark.

Diluted acids, that is water acidulated with muriatic, sulphuric, nitric, or acetic acid, but especially with the first of them, effect exhaustion completely either by percolation at common temperatures, or by the method of decoction; and they are much resorted to on that account by manufacturing chemists in their processes for separating the alkaloids. The diluted alkalis on the contrary, as well as their carbonates, do not act on the alkaloids, but decompose their natural salts, leaving the bases undissolved, and dissolving cinchonic-red, cinchonic-yellow, tannin, and fatty matter. Hence they are sometimes employed for removing these impurities, as the first step in the manufacture of the alkaloids and their salts. (See the article *Quinæ Sulphas.*)

The watery infusion and decoction of cinchona-bark present under the action of various reagents a considerable variety of appearances, from which pharmacologists have tried to deduce more simple and positive tests than external characters supply, for distinguishing true from spurious barks, fine true barks from those which, though true, are inferior in quality, and likewise the fine barks from one another. In infusions of the true barks ammonia and potash throw down chiefly the alkaloids; bichloride of mercury and neutral chloride of platinum produce insoluble double salts of the alkaloids; astringent solutions produce insoluble tannates of the alkaloids; tartar-emetic, sulphate of iron, and gelatin, owing to the presence of tannin, precipitate tannates of iron, of antimony, and of gelatin, and sometimes throw down cinchonic-red also; oxalate of ammonia, and likewise in strong infusions sulphate of soda, throw down oxalate or sulphate of lime; and iodide of po-

tassium also causes precipitates of a complex nature. On comparing together the facts obtained with such tests by several experimentalists, as well as those observed in some trials of my own, the results have turned out in general so discordant that it is unnecessary to state them here in detail, or to mention more than the general conclusions deducible from my own experiments. The best reagents for distinguishing the kinds and qualities of the different sorts of bark are ammonia, iodide of potassium, infusion of galls, and solution of isinglass. These were applied to infusions of the several barks made by infusing them in four parts of boiling-water for twenty-four hours, and then filtering the cold liquors. Ammonia causes with the four finest barks, crown, gray, yellow, and red-bark, a more or less abundant precipitate, soluble in an excess of the reagent; but it occasions no precipitate, with ash or rusty-bark, the two Carthagena barks, or the red-bark of Bogotà. Iodide of potassium causes sooner or latter a yellowish-white or yellowish-red precipitate with gray, yellow, or red bark, but not with crown, ash, or rusty-bark, or the two Carthagena barks. Infusion of galls does not cause a precipitate with rusty-bark, or the red-bark of Bogotà, but affects all the others. Gelatin conversely causes a copious brownish precipitate with rusty-bark, and the red-bark of Bogotà, but not with any of the rest. Sulphate of soda causes with good yellow-bark a considerable muddiness, passing slowly to a grayish-white precipitate; but it does not affect similar infusions of crown, silver, or ash-bark. These results agree in general, though not altogether, with what have been obtained in an elaborate investigation by Anthon, as related in Buchner's Repertorium, ii. series, Vol. iv.

Adulterations.—It may be inferred from what has been said as to the number of cinchona-barks and their differences in quality, and from the well-known extent of demand for the finer kinds, that the practice of adulteration must here meet with a wide field for its exercise. The inferior true barks are often mixed with the finer varieties or altogether substituted for them; sometimes true barks exhausted by decoction are mingled with them; and sometimes too barks entirely spurious are employed for the same purpose. The inferior true barks have been already described. In the present place a few observations will be necessary on the spurious barks, or those derived from other plants than the genus *Cinchona*. The adulterations of this kind have not been much studied in Britain; where indeed they seem to be less frequent than upon the continent.

The most important spurious barks are Piton-bark, Caribean-bark, and Pitya-bark. The first two are obtained from a genus of plants once confounded with the cinchonas, but distinguished, as formerly mentioned, by Humboldt and Bonplandt, and arranged by them in their new genus *Exostemma*. The source of the third bark is doubtful.——Piton, or St Lucie, Bark is derived from the

Exostemma floribundum, a tree about forty feet high, which inhabits hilly parts in the West-Indian islands. It is quilled, cylindrical, towards three-quarters of an inch in diameter, generally thin, brittle, and light, of a deep gray colour externally, wrinkled longitudinally, sometimes presenting a few transverse fissures, and on the inner surface grayish-black with longitudinal whitish lines. It closely resembles the next kind of bark, but is distinguished by the layers of the inner bark being more easily separated. Its powder is dull brown. Its has a very strong and disagreeable bitter taste. It has been occasionally used as a febrifuge since 1742, when Desportes first took notice of it, and was long believed to be produced by a *Cinchona*. But it is now little prized and seldom seen. It contains neither of the cinchona alkaloids, but an emetic principle analogous to the emeta of ipecacuan (Pelletier).——Caribean-bark is obtained from a shrubby plant of the same genus, the *Exostemma Caribaeum*, also a native of the West Indies. This is a thin dense bark, whitish externally, deep orange on a fresh fracture, brownish-black on its inner surface, like yellow bark when pulverized, and of a strong, disagreeable, bitter taste. It was first described by Jacquin in 1754 as the bark of a species of *Cinchona*, and was once thought a good febrifuge; but its real character is now better known. Like Piton-bark, it is emetic, and not a tonic. ——Pitaya-bark is a term to which different pharmacologists attach different meanings. It is sometimes applied to the woody-Carthagena bark, one of the inferior true varieties; and sometimes, more correctly, to a bark from the mountain of Pitaya in Columbia, which appears identical with the China bicolorata of some late Italian writers. It seems to have been also imported into Europe under the names of Tecamez-bark and Piaoi-bark. Guibourt thinks it is probably the bark of an *Exostemma*. He describes it as quilled, thin, compact, grayish-yellow externally, blackish or deep brown internally, and of a disagreeably bitter taste approaching to that of angustura-bark. A specimen in my possession from Italian commerce is in quills three-quarters of an inch in diameter, grayish-brown externally with large sharply-defined grayish-white and deep yellowish-brown patches. Some years ago it was held in high estimation by Brera and other Italian physicians. It contains neither cinchonia nor quina, but a peculiar crystalline alkaloid (Folchi and Peretti) which has been called Pitaïna.——M. Guibourt describes two other spurious barks as the produce of *Exostemma peruvianum* of Peru, and *Exostemma souzianum* of Brazil, but they are too rare in European commerce to be of any consequence to the pharmacologist.

The detection of the adulterations of the finer cinchona-barks is an object of great practical consequence, but also of considerable difficulty. Impurities or substitutions may be discovered, when the bark is in fragments of moderate size, either by their external characters, or by the effects related above of various reagents on

their infusions. But the most common fraud, the contamination of powdered bark with inferior, effete, or spurious barks, is a difficult matter to detect. Druggists chiefly judge of the genuineness of the powder by its sensible qualities,—its colour, its pure, strong, aromatic, evanescent bitterness, and the peculiarity and strength of its aroma. But this method requires great experience, and even at best is fallacious. Chemical tests have therefore been proposed for the purpose. Some of these are founded on the amount of precipitate occasioned in an infusion of given strength by certain reagents, such as infusion of galls, chloride of platinum, and bichloride of mercury, which all throw down insoluble compounds with the alkaloids of cinchona. A practised person may in this way judge of the purity of a specimen with considerable accuracy. The strength and purity of one species, the yellow-bark of commerce, may be estimated with some exactness by the amount of calcareous precipitate caused by sulphate of soda or oxalate of ammonia; because it is held, that the proportion of quina in this species corresponds with its proportion of cinchonate of lime. This method is unfortunately of limited application; for the other barks, more especially fine crown and gray bark, contain little lime. Other methods, and these the most accurate, yet also the most troublesome, consist in a process of analysis with a view to separate the alkaloidal principles in a state of purity. Probably the most convenient and exact upon a moderate scale of operations is the method for preparing the sulphate of quina recommended in the Edinburgh Pharmacopœia. Somewhat different from this, yet still fundamentally analytic, is the method proposed in the same work for testing the quality of yellow-bark. A decoction of one hundred grains in powder being decomposed by a large excess of carbonate of soda, the impure alkaloid thus separated is deprived of much of its impurity by gradually heating it in the liquid in which it has been thrown down; during which proceeding the precipitate is drawn together, as it were, till it forms a single semifused mass, which concretes as it cools into a firm cake. The cake weighs at least two grains, if the specimen of bark be good; and it is entirely soluble in oxalic acid, if no carbonate of lime was separated from the decoction by the carbonate of soda. This process is easily managed, because the precipitate is collected for weighing without the step of filtration. The whole alkaloid indeed in the bark is not obtained; but the principle of the method is not vitiated by that circumstance, because the proportional deficiency increases with the poverty of the bark. Therefore, although it may not answer for determining the exact relative value of different barks, it seems well fitted for ascertaining whether each comes up to a given standard.

Actions and Uses,—Cinchona-bark is in action eminently tonic, somewhat astringent, and topically antiseptic. Through means of these properties it improves digestion in functional derangements

of the stomach, and invigorates the nervous as well as muscular system in diseases of debility generally, but especially in convalescence from acute or chronic disease. It possesses beyond all other remedies the property of arresting ague, remittent fever, and periodic neuralgia. It was at one time held also to be endowed with the power of counteracting the typhoid tendency of some continued and eruptive fevers, and of checking gangrene in most of its forms; but these virtues are now properly no longer confided in. Although familiarly called a febrifuge, it has really no power of arresting or subduing the febrile state generally,—as presented for example in continued fever, exanthematic fevers, or febrile inflammations: Its anti-febrile properties are limited to those fevers which present the character of periodicity. On this account, and likewise because it also arrests other periodic diseases, such as neuralgia, cinchona ought rather to be designated an anti-periodic than a febrifuge; the latter of which terms may tend to perpetuate serious theoretical as well as practical errors.

All the most important physiological and therapeutic properties of cinchona-bark are concentrated in its alkaloids cinchona and quina. These have consequently been substituted in a great measure in practice for the galenical preparations of the crude drug. Quina in particular has come so universally into use in the form of disulphate, as to have in a great measure superseded the bark in all its cruder forms. I am assured by the principal druggists of this city, that they now seldom receive a prescription from medical practitioners for any of its galenical preparations, or for any thing else than disulphate of quina. Under the head of that salt a detailed view will be found of its actions and uses, which will apply in most particulars to cinchona-bark itself, and therefore needs not to be re-stated here.—Prejudice, together with the unquestionable energy of quina as a remedy, has led to the other alkaloid, cinchonia, being overlooked in practice. The equally strong prepossessions, however, which were long entertained in favour of crown-bark as a febrifuge and stomachic, though it contains little quina, or perhaps none at all, and the proofs which have been given of the great efficacy of gray or Huanuco-bark, would justify the inference that cinchonia too is eminently active. Accordingly trials made with it by Dr Bardsley in England, as well as by various practitioners of credit in France, Germany, and Italy, seem to leave little doubt that it is scarcely inferior to quina in the treatment of intermittent fever. And some continentalists even maintain, that, while equally energetic, it is likewise less apt to disorder the stomach in large doses. It has been commonly given in the form of disulphate.

Notwithstanding the general substitution of disulphate of quina for the galenical preparations of cinchona-bark, the effects of the latter are not absolutely identical with those of the former; and

there are not wanting individuals who maintain, that the alkaloidal salt is inferior for some purposes to the infusion, decoction, tincture, extract, or powder of the bark. These forms undoubtedly present astringent properties not possessed by disulphate of quina. But as their astringency is not great, the difference is unimportant. Their aroma is also thought by some to give them a superiority as stomachics. Nay, it is alleged that they in consequence do not cause sickness, pain in the stomach, and excitement of the circulation, where these symptoms are occasioned by sulphate of quina (Pereira). And it has even been averred, that, in some endemics of ague and remittent fever in hot climates, the bark itself has been found effectual, though disulphate of quina was comparatively inefficacious. The reverse however of these two propositions is the more general rule. In the treatment of severe agues in particular the salt of quina is general far more efficacious than the bark itself; and it is less apt to be discharged by vomiting.

Much has been written on the relative energy of the different kinds of cinchona-bark. All statements hitherto made on this subject are fallacious, owing on the one hand to the frequency with which the finer sorts have been confounded or adulterated with the weaker qualities, and on the other to the ignorance which prevailed till lately as to the best modes of making their officinal preparations. On the whole, it is probably difficult to say whether the gray, red, or yellow bark is the most powerful, when genuine; but the last is at present the favourite sort. Each variety has been held to possess advantages over the rest for particular purposes; but these opinions too have been vaguely formed. There is certainly no sound reason for the preference given to crown-bark by the English and Irish Colleges for making the galenical preparations of their Pharmacopœias; and this preference has been correctly departed from by the Edinburgh College and in all other recent national Pharmacopœias.

Of the galenical preparations the simple powder is the most energetic and useful as a febrifuge, or anti-periodic. But for other purposes the infusion, tincture, or extract is preferable, as being less apt to derange the stomach. In some cases the nauseating influence of these preparations is corrected by five or six grains of aromatic powder or a scruple of cinnamon powder with each dose. For certain purposes cinchona is united with other remedies of parallel action. In dyspepsia a useful compound of this kind is the *Vinum gentianæ* of the Edinburgh Pharmacopœia; and the Dublin College has a tonic compound mixture for cases of debility from exhausting or protracted diseases, the *Mistura ferri composita;* which however is rather an unchemical preparation.

The doses of the officinal preparations are *Cinchonæ pulvis,* gr. x. ad gr. lx. repeatedly, as a tonic; dr. i. ad dr. ii. often, as a febrifuge.—*Infusum cinchonæ,* fl. unc. i. ad fl. unc. iv.—*Decoctum cin-*

chonæ, fl. unc. i. ad fl. unc. iv.—*Tinctura cinchonæ*, fl. dr. i. ad fl. dr. ii. as a tonic.—*Tinctura cinchonæ composita*, fl. dr. i. ad fl. dr. ii. as a tonic.—*Extractum cinchonæ*, gr. v. ad gr. xxx. as a tonic.

CINNAMOMUM, *E. L.* CINNAMOMI CORTEX, *D.* *Bark of Cinnamomum Zeylanicum, Nees von Esenbeck, Laurineæ.—Hayne's Darstellung, &c. (Edin.) Bark of Laurus Cinnamomum, L. (Lond. Dub.) Cinnamon.*

CINNAMOMI OLEUM, *E. L. D.* *Volatile oil of the Bark of Cinnamomum Zeylanicum, &c. ut supra.*

TESTS, *Edin.* Cherry-red when old, wine-yellow when recent, odour purely cinnamonic: nitric acid converts it nearly into a uniform crystalline mass.

AQUA CINNAMONI, E. L. D.

PROCESS, *Edin.* Take of
Cinnamon bruised, eighteen ounces;
Water, two gallons;
Rectified spirit, three fluidounces.
Mix them, and distil off one gallon.

PROCESS, *Lond.* Take of
Cinnamon bruised, a pound and a-half;
Cinnamon-oil, two drachms;
Proof spirit, seven fluidounces;
Water, two gallons.
Distil off one gallon,

PROCESS, *Dub.* Take of
Cinnamon-bark bruised, one pound;
Water, enough to prevent empyreuma.
Macerate for a day, and distil off one gallon.

CONFECTIO AROMATICA, L. D.

PROCESS, *Lond. Dub.* Take of
Cinnamon, two ounces;
Nutmeg, two ounces;
Cloves, an ounce;
Cardamom, half an ounce;
Saffron, two ounces;
Prepared chalk, sixteen ounces.
Dry them, reduce them to fine powder, add water gradually and beat them into a pulp, *Dub.*
Reduce them when dry to fine powder; keep this in a close vessel. When the confection is wanted, add by degrees water, and make a proper mass, *Lond.*

ELECTUARIUM AROMATICUM, E.

PROCESS, *Edin.* Take of
Aromatic powder, one part;
Syrup of orange-peel, two parts;
Mix them and triturate them into a uniform pulp.

EMPLASTRUM AROMATICUM, D.

PROCESS, *Dub.* Take of
Frankincense, three ounces;
Yellow wax, half an ounce;
Cinnamon-bark, in fine powder, six drachms;
Pimento-oil, and
Oil of Lemons, of each two drachms.
Melt the wax and Frankincense together and strain, and while they are concreting as they cool, mix the powder previously triturated with the oils, and make a plaster.

PULVIS AROMATICUS, E. D.

PROCESS, *Edin.* Take of
Cinnamon,
Cardamom-seeds, and
Ginger, of each equal parts.
Reduce them to very fine powder, to be kept in well-closed glass vessels.

PROCESS, *Dub.* Take of
Cinnamon-bark, two ounces;
Cardam.-seeds without the capsules, and
Ginger, of each an ounce;
Long Pepper, one drachm;
Beat them together into a powder.

PULVIS CINNAMOMI COMPOSITUS, L.

PROCESS, *Lond.* Take of
Cinnamon, two ounces;
Cardamom, an ounce and a half;
Ginger, one ounce;
Long Pepper, half an ounce.
Rub them into a very fine powder.

SPIRITUS CINNAMONI, E. L. D.

PROCESS, *Edin.* Take of Cinnamon in coarse powder, one pound. Proceed as for Spirit of Caraway, p. 276.

PROCESS, *Lond.* Take of

Cinnamon-oil, two drachms;
Proof-spirit, a gallon.
Mix and distil off a gallon with a gentle heat.

PROCESS, *Dub.* Take of
Cinnamon-bark bruised, one pound;
Proof-spirit one gallon;
Water enough to prevent empyreuma.
Macerate for twenty-fours, and then distil off one gallon.

TINCTURA CINNAMOMI, E. L. D.

PROCESS, *Edin.* Take of
Cinnamon in moderately fine powder, three ounces and a half;
Proof-spirit two pints.
Proceed by percolation or digestion, as directed for Tincture of cassia.

PROCESS, *Lond. Dub.* Take of
Cinnamon, bruised, three ounces and a half;
Proof-spirit, two pints (old wine measure, D.)
Macerate for fourteen hours and strain.

TINCTURA CINNAMOMI COMPOSITA, L. E.

PROCESS, *Lond. Edin.* Take of
Cinnamon bruised (in coarse powder or fine, if perlocation be followed, E.) an ounce;
Cardamom-seeds bruised, half an ounce (one ounce, E.)
Long Pepper ground finely, three drachms (two and a half, L.);
(Ginger sliced, two drs. and a half, L.)
Proof-spirit, two pints.
Macerate for fourteen days, L. and strain.
This tincture is best prepared by percolation as directed for the compound Tincture of Cardamom. But it may be also made in the ordinary way by digestion for seven days, straining and expressing the liquor, and then filtering it (*Edin.*)

FOR. NAMES.—*Fren.* Cannelle de Ceylan.—*Ital.* Cannella regina; Cinnamomo.—*Span.* Canela de Holanda; Canela de Ceylan.—*Port.* Canella.—*Ger.* Zimmt; Ceilandischer zimmt.—*Dut.* Kaneel.—*Swed.* Acta kanel.—*Dan.* Kaneel.—*Russ.* Koritsa.—*Arab.* Darsini.—*Pers.* Darchinie.—*Tam.* Karruwa puttay.

FIGURES of Cinnamomum zeylanicum in Hayne, xii. 20, 21—as Laurus Cinnamomum in Nees von E. 128—as Laurus Cassia in Bot. Mag. 1636.

CINNAMON is in all probability the Κινναμωμον of the Greek physicians, and was also previously well known as a spice to the Israelites and many Eastern nations. It is the produce of the *Laurus Cinnamomum* of Linnæus, now better characterized under the name of *Cinnamomum zeylanicum* by Blume, Hayne, Nees von Esenbeck, Lindley, and other botanists.

Natural History.—This plant belongs to the Natural family *Lauraceæ* and to Linnæus's class and order *Enneandria Monogynia.* It grows naturally, with slight differences of botanical characters, in Ceylon, the Malabar coast, Sumatra, Borneo, and probably other parts of the continent and isles of Eastern Asia; and it has been successfully transplanted to Java, Bourbon, Mauritius, Cayenne, and the West-Indian islands. Nowhere however does it thrive so well, or yield such fine cinnamon, as on Ceylon. It chiefly abounds in the south-western district of that island, between Matura and Negombo; and beyond those limits the cinnamon produced by it is inferior in quality. It is a tree about thirty feet high and at most fifteen inches in diameter. The leaves present considerable varieties of form, being commonly ovate, often oblong-ovate, sometimes even cordate; but these and other trivial differences will not warrant the attempts made by Hayne and other botanists to establish several subspecies of the cinnamon tree. It may be distinguished from the species which in all probability produces the Chinese or common variety of Cassia-bark, namely *Cinnamomum Cas-*

sia or *aromaticum*, by the following characters. The leaf, whatever may be its form in other respects, is drawn out to a long, tapering, blunt point; it presents three principal nerves, which come in contact with one another a little above its base but without uniting, and two shorter nerves external to these; the young twigs, leafstalks, and nerves of the leaf are shining, bare and wholly free of the slightest appearance of down; and the leaf has more the taste of cloves than of cinnamon. The general appearance of the tree however, resembles that of *Cinnamomum Cassia;* which has consequently been often confounded with it (see *Cassiæ Cortex.*)

The Cinnamon-tree yields a variety of useful products. Its bark constitutes the Cinnamon of commerce; and from the same part is obtained the Oil of cinnamon. Its ripe fruit yields a concrete oil, called cinnamon-suet, which is sometimes burned at Ceylon in lamps. Camphor is found in its root. It has also been supposed to produce a part of the cassia-bark of commerce; and the flower-buds, it has been thought, may be substituted for the cassia-buds of the shops. The best account of these products has been given by Mr Marshall and by Leschenhault; whose authorities have been followed in a great measure in the subsequent description.

Cinnamon.—The cinnamon of European commerce comes chiefly from Ceylon, but partly from Malabar. On the island of Ceylon the finest qualities are obtained upon the southwestern coast, where the soil is light, sandy, but rich, and the weather generally rainy during the southwest monsoon from May till November (Leschenhault). The bark is partly collected from wild plants growing in the jungles; but more than two-thirds of it is got from cultivated plantations in the vicinity of Colombo. These plantations, or cinnamon-gardens as they are called, are towards 10,000 acres in extent. No great preparation is required to form them beyond clearing the ground, and afterwards preventing the plants from being choked up by other vegetables. Young plants are obtained by means of cuttings in October and November, and from seeds between June and August. The seeds, which must be put into the ground soon after they ripen, commonly spring in two or three weeks. The young plants thrive best under the shade of other shrubs. In six or seven years, sometimes even in fifteen months, they will furnish some shoots for making cinnamon; and after this the young shoots may be cut for the purpose every three or four years. The best qualities are got from twigs not less than half an inch, or above three inches in diameter. They are cut during the wet season when full of sap, and are immediately peeled. The bark is then put up in bundles and left for twenty-four hours; after which it is easily deprived of its epidermis by scraping it while stretched over a cylinder of wood. It then curls into quills, which, before they become hard, are thrust within one another to form pipes or rolls about forty inches in length. These are dried on hurdles, first in the shade, and afterwards thoroughly in the sun, then sorted into three qualities known in trade as first, second and third cinnamon,

and finally put up for exportation in bales weighing 92½lbs. The average importation of cinnamon into London is 5500 bales, or 500,000 pounds, of which about a fortieth comes from the Malabar coast and the rest from Colombo (Public Ledger, Jan. 29, 1840).

There are at least seven varieties of cinnamon distinguished in English commerce as First, Second, and Third Ceylon cinnamon, and First, Second, Third, and Fourth Malabar cinnamon. Their respective values may be best learned from their wholesale prices, which, at the commencement of 1840, were from six to seven shillings per pound for First Ceylon cinnamon, from four and sixpence to five and sixpence for Second Ceylon, from three and sixpence to four and sixpence for Third Ceylon, from fifteenpence to four and ninepence for the first two Malabar sorts, and from ninepence to eighteenpence for the last two.

The finest or First Ceylon cinnamon, which constitutes about a tenth only of the whole, is met with in the shops of this country in the form of rolls, about half an inch in diameter and forty inches long, and composed of many quills within one another. The quills are little thicker than cartridge paper, and on their outer surface clear yellowish-brown, smooth, dull, but intersected by paler threads, somewhat glistening, but not prominent. They possess a rich, pure odour peculiar to this bark, and also a peculiar taste, aromatic, sweetish, slightly astringent, and pungent, though much less so than cassia-bark. They are brittle and easily pulverizable, and the powder has a yellowish-brown hue, slightly inclining to reddish-brown. The aroma diminishes with time, though very slowly; for a cane in my possession, at least sixty years old, still retains it in some measure.

The other varieties of cinnamon differ from what has now been described, inasmuch as the rolls are often of greater diameter, the colour more inclined to reddish-brown, the quills thicker and on their outer surface rougher, the taste more astringent and less strongly aromatic, and the odour feebler. It requires an experienced judge however to distinguish the second from the first Ceylon cinnamon; and the First Malabar variety differs from these chiefly in the greater diameter of the rolls and its weaker taste and smell. The other Ceylon and Malabar sorts consist of barks approaching more to cassia-bark in thickness. Some still coarser kinds, for authentic specimens of which I am indebted to the kindness of Mrs Walker, lately resident at Colombo, and which are not allowed to be exported from Ceylon as articles of commerce, are still thicker, rougher and somewhat warty externally, dirty-reddish-brown in colour, and of very feeble fragrance and taste. These are the produce either of the larger branches of good plants, or of inferior plants in an unfit soil or situation. Young plants yield a pale cinnamon with little aroma; a strong soil produces a nearly tasteless bark; and a moist soil yields a brown bark, rugged, and feebly aromatic.

Chemical History.—Cinnamon yields its sensible qualities and medicinal virtues to water, and more readily to alcohol or spirit. The last of these solvents is used for making the officinal *Tinctura cinnamomi* and *Tinctura cinnamomi composita* of the Pharmacopœias; which are most conveniently prepared, as the Edinburgh College has indicated, by the method of percolation. When water or spirit is distilled from the bark in a state of fine division, a volatile oil passes over, which is held in solution by the spirit, and in the case of water is partly dissolved, but partly forms insoluble globules. In this way are obtained the pharmaceutic *Spiritus*, *Aqua*, and *Oleum cinnamomi.* Unless the bark be of fine quality, the spirit and distilled water of cinnamon are apt to be too weak; on which account, and also because the finer cinnamons constitute a small proportion of what is met with in the market, the London College directs the oil to be used instead of the bark for the former of these preparations, and a little oil to be added to the water along with the bark in preparing the latter. The other pharmaceutic preparations of the Pharmacopœias do not require any notice here. According to the analysis of Vauquelin, cinnamon consists of ligneous fibre, mucilaginous extract, tannin, resin, colouring matter, an acid, and volatile oil. The tannin is of the nature of catechu-tannin, as it gives a dark green precipitate with the salts of iron. The oil forms about six parts in one thousand of recently prepared bark.

Adulterations.—The cinnamon of the shops is often spurious. In the first place cassia-bark is prevalently sold in this country under the name of cinnamon, and one must ask in most shops for *True* cinnamon in order to obtain that article. On the continent the same confusion of terms exists and is kept up by the name of Chinese cinnamon, given there to the best kind of cassia-bark. The two barks are easily distinguished; for cinnamon consists of much more compound quills than cassia, the quills are very much thinner, and it has a purer cinnamon odour, as well as a sweeter, less pungent taste. The cinnamons, which are coarse enough to equal cassia in thickness, are generally rougher on their outer surface, and always of a weaker, much less pungent, but sweeter taste. ——Secondly, the finer cinnamons are often adulterated with the coarser qualities; the Ceylon kinds are sometimes mixed with those from Malabar; and in particular the powder of the fine cinnamons is imitated by a mixture of the inferior Ceylon sorts with the first and second Malabar kinds, which possess the requisite lightness of colour to qualify the dull tint of the former. Impositions of this kind are to be detected only by skill in the sensible qualities of the various cinnamons.——Lastly, another counterfeit article, made up in this country, consists of cinnamon deprived of its oil in preparing its pharmaceutic compounds, and then pulverized with good cinnamon or cassia to restore in some degree its odour and taste. This sophistication may also be known by external characters, in particular by its comparatively feeble aroma.

Oil of Cinnamon is prepared at Colombo from rejected cinnamon and the chips produced in the sorting process.

Chemical History.—This oil is obtained by macerating coarsely-powdered bark for two days in sea-water, adding muriate of soda, and then distilling off the water. About a third of the oil floats and the rest sinks in the water which comes over; and the whole amounts on an average to eight ounces from eighty avoirdupois pounds of recently prepared cinnamon, or a 160th part. Some cinnamons yield even ten ounces; but that which has been some years in store will not give above seven. The annual manufacture at Colombo amounts to about 400 quart bottles. The light and the heavy oils seem identical except in density, and they bear the same price. They are usually kept apart in the Colombo market. The density of this oil is sometimes stated so high as 1074 (Geiger); but specimens in my possession vary from 1038 to 1041 only. Its colour when recent is wine-yellow, which in the course of time slowly passes to cherry-red. The latter tint is indeed held by some to be a proof of lowness of quality. But two old specimens in my possession, which I have every reason to suppose genuine, possess a cherry-red hue. It has a powerful pure cinnamon odour, and a corresponding taste, with more sweetness and less pungency than oil of cassia. Its chemical relations have not been examined with care; but it is probable that the interesting discoveries of Dumas and Peligot as to the nature and properties of oil of cassia will also apply to oil of cinnamon. By exposure to the air it attracts oxygen, and crystals are deposited, as is often observed in old specimens. These are cinnamonic acid. When treated with concentrated nitric acid added very gradually to avoid violent action, the mixture speedily becomes on cooling a mass of crystalline scales; but if the acid be added suddenly, much heat is developed, and the crystallization is produced less completely and only after many hours. The crystals are a compound of the acid and the oil, as will be found more fully explained under the head of oil of cassia.——Oil of cinnamon is an officinal substance, being sometimes used, and by the London College recommended, for preparing the spirit and distilled water. It is in great request with the cook and the confectioner; by both of whom however oil of cassia is commonly substituted for it.

Adulterations.—It is very liable to adulteration in consequence of its high price, which is still from five to eight shillings an ounce, and a few years ago was three times as great. The greater part of what is sold by druggists and grocers is nothing else than the cheaper oil of cassia; but this may be easily distinguished by its less pure cinnamonic odour, inferior sweetness, and greater acrimony. The true oil is also said to be often adulterated with other substances, the nature of which is not exactly known, but which have all the effect of rendering the aroma weaker and less pure, and the action of nitric acid less complete and often indistinct.

disappears on cooling; a stronger heat fuses it; and if the heat be raised to full redness, sublimation takes place and crystalline needles are formed. If however the oxide be exposed to the air when heated, a sudden glow of redness passes throughout the mass, and antimonious acid is produced by the metal passing to a higher degree of oxidation, in which state it is less fusible and not volatile. The oxide of antimony is the base of all the common antimonial salts, and the active part of all the medicinal preparations of this metal. It is a sesquioxide, consisting of two equivalents of antimony and three of oxygen ($Sb^2 + O^3$), or 125·2 of the former and 24 of the latter.

Adulterations.—Its adulterations have not attracted attention, because it is not currently met with in the shops. That which should chiefly be kept in view is antimonious acid; for this compound, which is inert, may be formed if the oxide be carelessly made by the employment of too much nitric acid in dissolving the sulphuret. The presence of a portion of antimonious acid may be known, according to the formula of the Edinburgh College, by its insolubility in muriatic acid; and the substitution of antimonious acid for the sesquioxide may be discovered by the same means or by its infusibility. The oxide is yellow if iron be present.

Actions and Uses.—The oxide of antimony is in its action an emetic, laxative, diaphoretic, sedative, and expectorant. It possesses in short the general properties of antimonials, as they are fully explained under the head of Tartar-emetic. In consequence of the late recommendations of various physicians in Ireland, I have tried it as a diaphoretic and sedative in catarrh and pneumonia, in doses varying from three to five grains. I have seen this amount cause vomiting, more frequently nausea, diaphoresis with nearly as much certainty as genuine James' Powder, and sometimes diarrhœa. Occasionally no appreciable effect was produced, whether physiological or therapeutic. Results equally variable were lately obtained in some trials with it in Glasgow, according to information communicated to me by Dr Clark; and it was there observed that doses of thirty or forty grains were sometimes apparently inert. M. Durrand considers that this variety in its action is owing to its containing variable proportions of sesquichloride; and that when quite free from chlorine, as when precipitated by carbonate of soda or ammonia from tartar-emetic, it is not emetic, but only a sedative and diaphoretic. Dr Clark's preparation, however, was a pure one; and on the whole, the sesquioxide seems to approach closely to James' Powder both in its virtues and in the irregular developement of them. It is best given in powder with jelly, or in pill with conserve of roses.

Its only officinal form is the simple powder, *Antimonii oxidum*, gr. iii. ad gr. x.

ANTIMONII OXYSULPHURETUM, *L.* See *Antimonii Sulphuretum aureum.*

ANTIMONII PULVIS COMPOSITUS, *L.* PULVIS ANTIMONIALIS, *E. D.* *A mixture chiefly of antimonious acid and phosphate of lime, with some sesquioxide of antimony and a little antimonite of lime. Antimonial powder.*

TESTS, *Edin.* Distilled water boiled on it and filtered gives with sulphuretted-hydrogen an orange precipitate: muriatic acid digested on the residuum does not become turbid by dilution, but gives an abundant orange precipitate with sulphuretted-hydrogen.

PROCESS, *Edin. Lond. Dub.* Take of Sulphuret of antimony in powder, 1 part; Horn-shavings, two parts. Mix them and throw them into a wide iron pot heated to redness (into a wide crucible heated to whiteness, L.); stir constantly till vapours cease to arise and an ash-gray mass is formed, which is to be removed, pulverised, and exposed for two hours to a heat gradually increased to whiteness, in a crucible covered with another crucible having a perforated bottom (in a proper crucible, L.) Reduce the residuum to a very fine powder.

FOR. NAMES.—*Fren.* Poudre antimonial.—*Ital.* Polvere antimoniale.

Chemical History.—ABOUT the middle of last century Dr James of London acquired great celebrity from his successful employment of a diaphoretic, the preparation of which he kept secret, and which has ever since been prepared by his heirs or representatives under the name of James' Powder. Although the inventor in the specification of his patent gave a process for preparing the powder, it was found impossible to attain success with his instructions; and nothing was known of its composition, except that it was a preparation of antimony, till Dr Pearson in 1791 announced it from his analysis to consist of phosphate of lime with about an equal weight of oxide of antimony. He was also led by his investigations to propose to make it by a process now adopted by the British Pharmacopœias, and which yields a compound generically a James' powder, though differing from the quack preparation in the proportion of its constituents. Dr Pearson's analysis of true James' powder being distrusted on account of the imperfect state of analysis in his time, various attempts have been made to elucidate its composition more exactly. Dr Pearson, Mr Phillips, and Berzelius found it to consist of phosphate of lime and antimonious acid, with, as Berzelius thought, a trace of antimonite of lime; and Chenevix and Mr Brande found, besides antimonious acid and phosphate of lime, a variable proportion of sesquioxide of antimony. More recently this inquiry has been resumed by Dr Douglas Maclagan, whose results are interesting and conformable with what I have obtained on repeating the chief part of his researches. According to his analysis true James' powder consists principally, as all prior experimentalists have thought, of phosphate of lime and antimonious acid; but it also contains one or two per cent of soluble antimonite of lime, and between four and ten per cent of sesquioxide of antimony. The antimonial powder of the Pharmacopœias differs from

the quack powder in presenting less antimonite of lime, and likewise a variable, but always inferior proportion of sesquioxide, never exceeding four per cent. The condition in which this oxide exists in the powder is peculiar. Possibly it is not free, as Chenevix and Brande imagined, but combined with lime and phosphoric acid in the form of a double salt, for its muriatic solution is not decomposed by water.

It is plain therefore that the Colleges are on the right road in their process for making antimonial powder. In this process the horn is first charred and the sulphur of the sulphuret of antimony burnt off, while the antimony is probably in the first instance reduced to the metallic state. Under the subsequent roasting however it is oxidated, as well as the carbonaceous residuum of the horn; and consequently there is left phosphate of lime with antimony in different degrees of oxidation, and partly free, partly combined. As the antimonious acid, constituting the greater portion of the antimonial contents, is well known to be inert in the free state, the activity of the preparation seems in all probability to be owing in part to the antimonite of lime, but chiefly to the sesquioxide; and therefore the great aim of the process should be to increase the proportion of that oxide, and to prevent it from being peroxidated. This object may be accomplished by regulating the degree of heat, the duration of the heat, and the access of air in the stage of incineration. It is much to be desired that farther experiments were made to determine these three conditions, because no one can deny that the antimonial powder of the Pharmacopœias is an irregular preparation, inferior in activity as well as certainty to the nostrum sold by Dr James' representatives.

On account of the irregularities introduced by the process of combustion and incineration Chenevix suggested the propriety of preparing antimonial powder in the moist way, by dissolving phosphate of lime and sesquioxide of antimony in muriatic acid, and adding ammonia to the solution. But this method must yield a very different compound.

Adulterations.—I am not acquainted with any adulterations, properly so called, to which the antimonial powder is subject. But, as the Edinburgh College indicates in the formula of tests, it may be rendered inert in consequence of containing neither antimonite of lime, which will appear from sulphuretted-hydrogen having no effect on distilled water boiled with it,—nor sesquioxide, as will appear from the same reagent having no effect upon muriatic acid digested with it and filtered after dilution. Most antimonial powders, it may be added, are much too coarsely pulverized, and also too gritty, though in pretty fine powder, as if they had undergone thorough vitrification in the process. The superiority of the patent article in this and other respects is probably owing to a more successful management of the heat.

Actions and Uses.—James' Powder and Antimonial powder are

in their action emetic, diaphoretic, laxative, expectorant, and sedative. They are uncertain emetics, and feeble compared with other antimonial preparations. They may in general however be given easily enough to induce and maintain nausea, and thus to act as powerful sedatives. They are laxative; but this action, like their emetic virtues, is precarious. Their most certain effect is diaphoresis; and on this account they are extensively used in febrile diseases. All practitioners complain, and with justice, of the uncertainty of the diaphoretic action of the officinal powder; which is owing partly to its irregular composition, but partly also to the acknowledged irregularity of the action of all antimonials except tartar-emetic. That twenty, thirty, or sixty grains of antimonial powder may sometimes have no effect at all of any kind, as several experimentalists complain, ought to excite no surprise now, when it is known how much the actions of all antimonials are apt to be altered or annihilated both by constitutional causes, and even by the very circumstance of an increase of dose. For information on this head the article on Tartar-emetic may be consulted.——At present the patent nostrum is preferred by practitioners, and it is unquestionably in general more active. Yet it is very far from being so free from uncertainty as most imagine. The investigations of Dr Maclagan seem to account both for the superiority and the irregularity of its effects. There are three kinds of it at present sold by different manufacturers; and all three seem from their composition superior to the pharmaceutic preparation. It should be given either with water alone, or in some saccharine vehicle, or in pill made with conserve of roses.

The dose of both the officinal and the patent *Pulvis antimonialis* is gr. iii. ad gr. viii. every three, four or six hours.

ANTIMONII SULPHURETUM, *E. D.* ANTIMONII SESQUISULPHURETUM, *L.* *Native Sesquisulphuret of Antimony.*

TESTS, *Edin.* Soluble entirely with the aid of heat in muriatic acid.

TESTS, *Lond.* Striated; soluble entirely with the aid of heat in hydrochloric acid; and deposits from this solution a white substance on the addition of distilled water, leaving a liquid which when filtered yields a reddish precipitate with hydrosulphuric acid.

ANTIMONII SULPHURETUM PRÆPARATUM.

PROCESS, *Dub.* Take any convenient quantity of sulphuret of antimony, and reduce it to a very subtile powder in the same way as prepared chalk.

FOR. NAMES.—*Fren.* Sulfure d'antimoine; Antimoine cru.—*Ital.* Solfuro d'antimonio.—*Span.* Antimonio crudo.—*Ger.* Schwefelspiessglanz; Grauspiessglanzerz.—*Swed.* Rå Spetsglans.—*Dan.* Spidsglands.—*Russ.* Dvutrech sernistaia surma.—*Arab.* Ismud.—*Pers.* Surmah.—*Tam.* Anjana kalloo.

THE NATIVE SESQUISULPHURET of ANTIMONY was used by the ancient Greeks under the names of Στιμμι, Στιβι, Πλατυοφθαλμον, and Λαρβασον, as an astringent and desiccative. It is not now used medicinally; but it is the compound from which all the antimonial

preparations of the Pharmacopœias are obtained. It is the most common of the ores of antimony.

Chemical History.—The ore is freed from impurities by fusion in a perforated crucible, from which the melted mass flows into another crucible placed below and sunk in the earth, so as to be protected in a great measure from the heat. Sulphuret of antimony is thus obtained in the form of conical loaves, in which state it is sold under the name of *Crude antimony.* The loaves have an ash-gray colour and some crystalline appearance externally, and they present an irregular fibro-foliaceous fracture, the surface of which is brilliantly metallic and nearly of the colour of lead when fresh cut. The density of this sulphuret is 4.6. It is permanent in the air, without taste or smell, insoluble in water, brittle, and easily reducible to an ash-gray powder, which inclines to reddish-brown in very pure specimens. It fuses at a moderate heat, and at a high temperature sublimes in close vessels without change. Heated in contact with the air, it parts with some sulphur in the form of sulphurous acid, while part of the antimony is converted into the sesquioxide,—forming a substance which was used till lately in medical practice and pharmacy under the name of *Glass of antimony*, and which appears to be an irregular mixture of oxide of antimony with a definite compound of the oxide and sulphuret. Heated with carbonate of potash, sulphuret of antimony forms a double sulphuret of antimony and potassium, once known in medicine by the name of *Liver of antimony*; and when this compound is boiled with water, a solution is obtained, which consists of sulphuret of potassium with a portion of sulphuret of antimony, and which yields on cooling a reddish-brown precipitate, not now in use in Britain, but still employed on the continent and named *Kermes-mineral.* Opinions are divided as to the nature of this substance; but it is probably when pure a hydrated sesquisulphuret. When the native sesquisulphuret is boiled with solution of caustic potash, it is dissolved; and the fluid on cooling deposits a reddish-brown powder, which has also been considered kermes-mineral, though probably different. But if the fluid, instead of being allowed to cool, is treated with muriatic acid, an orange precipitate falls down, which is probably a hydrated sesquisulphuret with some adhering or combined sesquioxide of antimony, and which still retains a place in the British Pharmacopœias under the designation of *Golden sulphuret of antimony.* When the sesquisulphuret is mixed with an equal weight of nitre and projected by degrees into a red hot crucible, the crucible is found to contain at the top the liver of antimony already mentioned; and at the bottom there is another layer of a brown colour, which when well washed is a definite compound of one equivalent of sesquioxide and two equivalents of sesquisulphuret (Proust), long known in medicine, and still used in some parts of the continent, under the title of *Crocus of antimony.* When the process just described is performed with two parts and a half of nitre to one of the sesquisulphuret, the product after being well

washed, yields a white insoluble powder, a mixture of antimoniate and antimonite of potash, which was also long a favourite antimonial, and was known by the name of *Diaphoretic antimony* from its supposed virtues. It is right to mention these chemical actions and products, that the student may know the precise meaning of terms, which often occur in works on Pharmacy and Materia Medica, and which denote substances once in high repute, but now abandoned,—fortunately for the simplicity of pharmaceutic science.——The sesquisulphuret of antimony is soluble with the aid of heat in hydrochloric acid, sulphuretted hydrogen being given off and a sesquichloride of antimony, or hydrochlorate of its sesquioxide, being dissolved. It is also soluble in nitric acid, which oxidates the metal and a part of the sulphur, so that a sulphate of antimony is obtained in solution, and some sulphur separates. It is soluble too in boiling alkaline solutions. It is composed of two equivalents of antimony and three of sulphur ($Sb^2 S^3$), and consequently contains 125.2 parts of the former and 48.3 of the latter.

Adulterations.—The sulphuret of British commerce always contains impurities; but it is not subject to adulterations in the correct sense of the term; and the impurities it usually presents do not interfere with its utility as the article from which other antimonial compounds are prepared. The chief characters stated by the London College are intended to ascertain its nature, not to indicate its purity. It ought to be entirely soluble in muriatic acid aided by heat; and such is the only test of its purity which is practically necessary in pharmacy. That character however will not detect the existence of two impurities which are seldom altogether wanting in the sulphuret of commerce, namely iron and arsenic. The presence of iron is shown by the yellow colour of the solution effected with muriatic acid. The presence of arsenic is beautifully shown, as Serullas pointed out, by obtaining an alloy of antimony and potassium from equal parts of the sesquisulphuret and cream of tartar heated to redness for three hours, and burning the hydrogen which is copiously evolved when the alloy is immersed in water: oxide of arsenic will be obtained from the arseniuretted-hydrogen which is mixed with the hydrogen gas. Neither of these impregnations is of much practical consequence, so far as regards British pharmacy. The iron disappears nearly or entirely in the processes which the sulphuret undergoes in the course of being converted into the officinal antimonials of this country. And Serullas has proved that the same is the case with the arsenic; although it appears that this metal, which is sometimes present in the proportion of five per cent, may be readily retained in several of the older medicinal preparations still employed on the continent.

Uses.—The native sesquisulphuret of antimony is inert in relation to the animal economy; but it was once used in medical practice in the form of fine powder prepared by levigation, to which the odd title of Alcohol of crude antimony was given. As already stated,

it is the compound of antimony from which all the officinal antimonials now used in this country are generally prepared.

ANTIMONII SULPHURETUM AUREUM, *E.* ANTIMONII OXYSULPHURETUM, *L.* ANTIMONII SULPHURETUM FUSCUM, *D.* *A mixture or compound of sesquisulphuret of antimony, sesquioxide of antimony and sulphur. Golden Sulphuret of Antimony.*

TESTS, *Edin.* Tasteless ; twelve times its weight of pure muriatic acid, aided by heat, dissolves most of it, forming a colourless solution, and leaving a little sulphur.

TESTS, *Lond.* Entirely soluble in nitro-hydrochloric acid, emitting hydrosulphuric acid.

PROCESS, *Lond. Dub.* Take of
Sesquisulphuret of antimony in fine powder, seven ounces ;
Aqua potassæ, four pints (eighteen parts to one of sulphuret, D.) ;
Distilled water, two gallons (no water, D.)
Boil the sulphuret in the solution of potash for two hours with a gentle heat, stirring occasionally, and replacing what water evaporates. Filter through cloth, and drop into the filtered liquid as much diluted sulphuric acid as will throw down the whole golden sulphuret (eleven parts or a sufficiency, D.) Wash the precipitate well, and dry it with a gentle heat.

PROCESS, *Edin.* Take of
Sulphuret of antimony in fine powder, one ounce ;
Solution of potash, eleven fluidounces ;
Water, two pints.
Mix the water and solution of potash ; add the sulphuret, boil for an hour, filter immediately, and precipitate the liquid while hot with an excess of diluted sulphuric acid. Collect the precipitate on a calico filter, wash it thoroughly with water, and dry it with a gentle heat.

FOR. NAMES.—*Fren.* Soufre doré d'antimoine.—*Ger.* Goldschwefel.—*Russ.* Doupati sernistaia surma.

THE GOLDEN SULPHURET OF ANTIMONY was probably known to Basil Valentin in the fifteenth century.

Chemical History.—This is one of the many antimonial compounds which have been proposed as substitutes for the inert native sesquisulphuret. Its chemical nature is not yet well understood. It has been successively viewed by chemists of good authority as the sesquisulphuret with adhering sulphur, a hydrated sesquisulphuret (Buchner), a hydrated bisulphuret (Geiger), a hydrosulphate of the sesquioxide with adhering sulphur (Paris *Codex*, 1837), and a hydrated sesquisulphuret with sesquioxide either combined (Phillips) or simply adherent (Berzelius). There is no sufficient ground for its new name of Oxysulphuret in the last London Pharmacopœia ; for if this title be intended to be chemically descriptive, it indicates a definite compound of sesquisulphuret and sesquioxide, which the Golden sulphuret of antimony has not been proved to be. That the sesquioxide is contained in it there can now be little doubt ; for a hot solution of bitartrate of potash dissolves that oxide from it,—according to Mr Phillips in the proportion of 12 per cent. But this ingredient is probably adherent, and not chemically combined.

The Golden sulphuret of antimony may be prepared by the action of the fixed alkalis or alkaline earths upon the native sesqui-

sulphuret either in the moist or dry way. When prepared in the dry way by heating the sesquisulphuret with carbonate of potash, carbonic acid is given off, a portion of the potash is decomposed, and a double sulphuret of antimony and potassium formed, as well as some oxide of antimony; and when the mass is dissolved in water the double sulphuret is taken up, while the oxide of antimony is dissolved by the undecomposed potash. Such is also the state of the solution obtained by the College process in the moist way by the action of solution of potash on the sesquisulphuret. On an acid being added to this solution, the potassium of the double sulphuret becomes potash by the decomposition of water, and unites with the acid used; while sulphuretted hydrogen formed with the hydrogen of the water is disengaged; and sulphuret of antimony, the remaining ingredient of the double sulphuret, falls down. At the same time the acid unites with the potash which holds the oxide of antimony in solution; and this too is in consequence precipitated. Farther, free sulphur is also commonly deposited, owing, as is believed, to the action of the air on the dissolved sulphuret of antimony and potassium.

So long as the true chemical nature of this substance is uncertain, the conditions for success in preparing it must be also obscure. It is probable however that one important condition is protection of the process from the free access of air, and another the precipitation of the fluid while it remains hot. Should the first condition be neglected, much free sulphur may be thrown down; and if the solution be allowed to cool before the addition of the acid, a considerable proportion of the compound falls down along with some adhering or combined potash (Berzelius), constituting the substance commonly called Kermes-mineral. It was stated under the former article, that kermes is probably when pure a hydrated sesquisulphuret. This is the opinion of Berzelius; who adds, however, that, as usually prepared, it contains some sesquioxide of antimony and potash.

The golden sulphuret of antimony is a light powder of an orange or golden colour, without taste or smell, insoluble in water, soluble with the aid of a gentle heat in alkalis, and partly soluble in muriatic or nitromuriatic acid. When heated in a tube sulphur is sublimed; but if heated in contact with the air it burns with a blue flame.

Adulterations.—This compound is probably not much subject to adulteration. The impurities indicated by authors in Pharmacy, namely sulphur, oxide of iron, and the red woods, such as saunder's wood, will be sufficiently detected by the simple test given by the Edinburgh College. That is, when a genuine sample of the golden sulphuret of antimony is acted on by muriatic acid, aided by heat, the sulphuret and oxide of antimony are dissolved, a very little sulphur is left, and a colourless solution is obtained. If there be any oxide of iron present the solution is yellow; if there be any of the

red dye-woods, these are left undissolved; if there be too much sulphur, this will be indicated by an unusual amount of residuum. A serious error has crept into the London formula of tests; in which it is stated that the golden sulphuret is entirely dissolved in nitro-hydrochloric aid, with the evolution of sulphuretted-hydrogen. In this acid the golden sulphuret is not entirely soluble, sulphur being constantly left unattacked; and during the action which goes on, no sulphuretted-hydrogen is given off, or a mere trace only at first.

Actions and Uses.—The golden sulphuret is not an inert preparation, as many think. But its effects, like those of all antimonial preparations that are insoluble in water, seem uncertain; to which inconvenience it is also not unlikely that its irregular composition somewhat contributes. It is diaphoretic, and in large doses emetic. In this country it is employed only as a diaphoretic alterative in conjunction with calomel, constituting the familiar Plummer's pill. Doubts may be entertained whether the small dose of the antimonial in this pill, amounting to one grain only in each, contributes at all to its effect; and these doubts will be strengthened, if the composition recently assigned to the golden sulphuret be established, namely that it contains a little sesquioxide; for the sesquioxide, which in that case will probably prove its only active ingredient, exists in small proportion. On the whole there is reason to suspect that the present preparation of antimony might be expunged without prejudice from the Pharmacopœias. It is undoubtedly the most uncertain of the antimonials now used in Britain; and it will accomplish nothing, which may not be much better attained by the pure sesquioxide, or by James' powder.

Its officinal forms and their doses are: *Antimonii sulphuretum aureum*, E. *Ant. sulph. fuscum*, D. *Ant. oxysulphuretum*, L. gr. v. ad xx. *Pilulæ calomelanos compositæ*, E. D. *Pil. hydrargyri chloridi compositæ*, L. gr. v. ad xx.

ANTIMONIUM TARTARIZATUM, *E.* ANTIMONII POTASSIO-TARTRAS, *L.* ANTIMONII ET POTASSAE TARTRAS, *D.* *Tartrate of Potash and antimony. Tartar-emetic.*

Tests, *Edin.* Entirely soluble in twenty parts of water: solution colourless, and not affected by solution of ferrocyanide of potassium: a solution in forty parts of water is not affected by its own volume of a solution of eight parts of acetate of lead in thirty-two parts of water, and fifteen parts of acetic acid.

Tests, *Lond.* Entirely soluble, without any bitartrate adhering to the vessel. The solution is precipitated reddish by hydrosulphuric acid, not at all by chloride of barium or nitrate of silver, and the precipitate occasioned by nitric acid is soluble in an excess of acid.

Process, *Edin.* Take of
Sulphuret of antimony in fine powder, four ounces;
Muriatic acid (commercial), one pint;
Water, five pints.

Dissolve the sulphuret in the acid with the aid of a gentle heat; boil for half an hour; filter, pour the liquid into the wa-

ter; collect the precipitate on a calico filter, wash it with cold water till the water ceases to redden litmus-paper; dry the precipitate over the vapour-bath.
Take of this precipitate three ounces, bitartrate of potash four ounces and a quarter, water 27 fluidounces. Mix the powders; add the water; boil for an hour; filter and crystallize by cooling. The mother-liquor when concentrated yields more crystals, not so free from colour, and therefore requiring a second crystallization.

PROCESS, *Dub.* The same, except that the oxide, bitartrate, and water are used in the proportion of four, five, and thirty-two parts, and that no use is made of the mother-liquor.

PROCESS, *Lond.* Take of
Sesquisulphuret of antimony in powder, two pounds;
Bruised nitrate of potash, two pounds;
Powder of bitartrate of potass, fourteen ounces;
Distilled water, a gallon;
Hydrochloric acid, four fluidounces.
Mix thoroughly the sesquisulphuret and nitrate, adding the hydrochloric acid by degrees. Kindle the powder on an iron plate. Pulverize the residue very finely when cold, and wash it often with boiling water till it is tasteless. Mix the powder thus obtained with the bitartrate of potash, and boil the mixture for half an hour with the distilled water. Filter the liquor while hot, and set it aside to crystallize. Remove and dry the crystals; and concentrate the residual liquid to obtain more.

VINUM ANTIMONIALE, E. LIQUOR TARTARI EMETICI, D. VINUM ANTIMONII POTASSIO-TARTRATIS, L.

PROCESS, *Lond. Edin.* Dissolve 40 grains of tartar-emetic in one pint of sherry.

PROCESS, *Dub.* Take of
Tartrate of potash and ant. a scruple;
Boiling distilled water, eight fluidounces;
Rectified spirit, two fluidounces. Dissolve the tartrate in the water and add the spirit.

UNGUENTUM ANTIMONIALE, E. TARTARI EMETICI, D. ANTIMONII POTASSIO-TARTRATIS, L.

PROCESS, *Edin. Lond. Dub.* Triturate very carefully together an ounce of tartar-emetic and four (eight D.) ounces of axunge.

FOR. NAMES.—*Fren.* Emétique.—*Ital.* Emetico; Tartaro-Emetico.—*Ger.* Brechweinstein.—*Russ.* Rvotnoi kamen.

TARTAR-EMETIC, the most important of all the compounds of antimony, is likewise one of the most valuable of all articles of the Materia Medica. Its name has been much tortured by reformers of pharmaceutic nomenclature. The original convenient term, Tartar-emetic, was successively changed to Tartarized antimony, and the Tartrate of antimony and potash; but now the London College has invented a newer designation still, which, according to the principles of nomenclature in its new Pharmacopœia, if it has any meaning at all, implies the belief of the College that this double salt is a compound, not of tartaric acid with two bases, but of one base, oxide of antimony, with a compound acid, potassio-tartaric acid, of which potassium is one of the radicles. No such acid is yet known.

Chemical History.—Tartar-emetic was discovered in 1631 by Mynsicht. Since then, several of the most eminent chemists in Europe have contributed either to our knowledge of its nature or to the facility of preparing it. A great variety of processes have accordingly been proposed, and have at different times been adopted in the Pharmacopœias of Britain. The object of the whole of them is to obtain from the sesquisulphuret of antimony

a sesquioxide more or less pure; which is then dissolved with the aid of heat in solution of bitartrate of potash. For this purpose the article at one time generally preferred was the glass of antimony formerly mentioned (p. 139) as an irregular mixture of sesquioxide of antimony with a definite compound of the sesquioxide and sesquisulphuret. By some it was thought preferable to employ the more definite compound long familiarly known by the name of crocus of antimony (p. 139.) Others, again, have considered it better to employ a more pure sesquioxide united with a little sulphuric acid, as obtained by decomposing sulphate of antimony with water. And more recently it seems agreed on by the best authorities, that the most convenient and certain method of all for obtaining at once a pure tartar-emetic, is to make use of an oxide similarly obtained from the chloride of antimony, as detailed in a former article (see *Antimonii oxidum.*) Such, in particular, is the result to which M. Henry of Paris was led after a more careful comparison of processes than any previously instituted. The Dublin College has the credit of having first adopted this method; and its example has been followed, with one or two trifling improvements, by the College of Edinburgh; but the London College, in deserting the old plan with the glass of antimony, has only exchanged it for another of the early and inferior processes with the crocus. It seems needless to discuss here any other methods except those followed in Britain.

When the sesquisulphuret of antimony and nitrate of potash are mixed in equal proportions, according to the London process, and set fire to, the nitre is decomposed, oxidates a portion of the sesquisulphuret, converting it into sesquioxide and sulphuric acid, and gives up its potash to the sulphuric acid thus formed. The sesquioxide at the same time unites with the remaining sesquisulphuret of antimony to form a definite oxysulphuret, the pure crocus of antimony. The purpose served by the muriatic acid is believed to be to prevent the formation of sulphuret of potassium or decompose it as fast as it is formed, and also to neutralize free potash which would otherwise be also produced. The sulphate and muriate of potash being now washed away, the crocus of antimony is left tolerably pure, and in a state in which it is easily attacked by the bitartrate of potash. The last stage of the process consists in dissolving out the sesquioxide from the crocus by mixing it with bitartrate of potash and boiling the mixture with water; upon which a tartrate of potash and antimony is formed and crystallizes on cooling, while sesquisulphuret of antimony is left undissolved. The College does not direct what is to be done with this residuum; but it may evidently be used as part of the materials for repeating the process.——In the process of the Edinburgh and Dublin Colleges there is first obtained a sesquioxide of antimony with a little adhering chloride, as described under the article *Oxidum antimonii;* and on this being boiled in water with bitartrate of potash, its

adhering chloride is resolved into hydrochloric acid and sesquioxide by the decomposition of water: the whole sesquioxide at the same time unites with the bitartrate of potash to form tartar-emetic; while the hydrochloric acid remains in the fluid, and helps to maintain oxide of iron and any other metallic impurities in solution at the time the tartar-emetic crystallizes. It is a positive disadvantage to purify, by alkalis, the sesquioxide precipitated by water from the chloride of antimony; for in that case the crystals of tartar-emetic are apt to be coloured by oxide of iron. The first crop of crystals obtained by this process is nearly or entirely colourless. More may be obtained by concentrating the mother liquor; but these are somewhat coloured with iron, from which they are freed by a second crystallization. The Colleges do not direct any farther use to be made of the mother liquors. On neutralizing the acid contained in them however by means of chalk, more crystals may be obtained by farther concentration; which must of course be attended to in operations on the great scale. After this third crystallization, the residual liquor yields on evaporation a gelatinous mass from which no more tartar-emetic can be obtained. It will be observed that the Edinburgh and Dublin Colleges differ as to the proportion in which the sesquioxide and bitartrate should be mixed to form the double tartrate,—the former recommending about 142 parts, the latter 125 only, of bitartrate to 100 of sesquioxide. I am persuaded that the Edinburgh proportions are correct; for on making the experiment with the proportions of the Dublin Pharmacopœia, some oxide was left undissolved; and on gradually increasing the quantity of bitartrate, a little insoluble matter was still left after 142½ parts were used. This corresponds closely with the results of the researches of Henry; who was led to recommend 145 parts of bitartrate as the proper proportion.

There is no comparison between the two processes now described in point of elegance, simplicity, and the perfection of the result; nor does there seem any obvious reason, why, after the researches of M. Henry, the London College should adhere to the old method. In point of economy there is even less capability of comparison. For, according to the proportions given in the London formula, one hundred parts of sesquisulphuret furnish oxide enough to require no more than sixty parts of bitartrate of potash; while by the Dublin method, modified in the Edinburgh formula, no less than one hundred and twenty-five parts of bitartrate are required, or above twice as much.

Tartar-emetic is met with in the shops sometimes in crystals, more commonly in powder. The powder is white when pure. The crystals, while in the solution from which they have formed, are transparent and colourless; but when removed from the fluid they soon become white and opaque. Their primary form is an octaëdre with a rhombic base. Tartar-emetic has a peculiar, metallic, nauseous taste, but no smell. It is somewhat efflorescent in

the air. Heat readily decomposes it, charring the mass and sending off dense vapours. In close vessels a kind of pyrophorus is the result, which probably depends for its property of spontaneous inflammability on an alloy of antimony and potassium being formed. But in the open air the heated carbonaceous residuum kindles, and if urged with the blowpipe globules of metallic antimony are produced. The salt is soluble in somewhat less than three parts of boiling, and fifteen of temperate, water. This solution spoils when long kept. Sulphuretted-hydrogen causes in it the precipitation of a beautiful orange-red hydrated sesquisulphuret; sulphuric acid throws down a basic sulphate of antimony in the form of a white powder; caustic potash occasions a white precipitate of sesquioxide soluble in an excess of the reagent; lime water throws down the sesquioxide and tartrate of lime. Of these reactions the effect of sulphuretted-hydrogen is by much the most characteristic. This is the best medico-legal test for tartar-emetic, even in organic mixtures. A little muriatic and tartaric acids being added to the suspected fluid to dissolve any antimonial compound which may have been thrown down, sulphuretted-hydrogen is transmitted through the filtered fluid; and the sulphuret obtained after ebullition is reduced in a tube by means of hydrogen gas aided by a low red heat. Tartar-emetic is soluble in proof-spirit and weaker spirituous fluids such as wine. A solution in sherry, which contains two grains to the ounce, is the familiar *Vinum antimoniale* of the Pharmacopœias. The salt is composed of two equivalents of acid, an equivalent each of protoxide of potassium and sesquioxide of antimony, and two equivalents of water,—or rather of one equivalent of tartrate of potash, one of tartrate of antimony, and two of water ($\bar{T}KO+\bar{T}Sb^2O^3+2HO$), that is 113.63 parts of the potash salt, 219.68 of the salt of antimony, and 18 of water.

Adulterations.—A great variety of adulterations of tartar-emetic have been indicated by authors in pharmacy. Among these may be mentioned bitartrate of potash, oxide of iron, lime, silica, sulphuric acid or a sulphate, and muriatic acid or a muriate;—which may be present, all of them from faulty preparation of the salt, and several of them as fraudulent additions. So far as regards the shops of this country, however, none of these impurities are so frequent as to be of the slightest consequence, except oxide of iron and bitartrate of potash. The former, from carelessness or want of skill on the part of the manufacturer, is sometimes present in such quantity as materially to affect the commercial quality of the salt, though scarcely its medicinal activity. The bitartrate of potash on the other hand is usually present as an express adulteration; and it is so common, that few samples of tartar-emetic, purchased in powder from the wholesale dealer, are entirely free of it.——Of the tests proposed by the London College two seem intended merely to determine the nature of the salt, namely, sulphuretted-hydrogen and nitric acid. The former throws down an orange sesquisulphu-

ret of antimony, the latter a white sesquioxide soluble in an excess of the reagent. Of the remaining tests, muriate of baryta shows sulphuric acid or a sulphate by causing a white precipitate,—acidulous nitrate of silver muriatic acid or a muriate by occasioning also a white precipitate,—and the process of solution detects bitartrate of potash, which is left in consequence of its comparative insolubility in cold water. The tests of the Edinburgh Pharmacopœia bear a reference only to the two adulterations actually prevalent. If much iron be present the solution of the salt is yellow, not colourless; and though the quantity present be insufficient to colour the solution, it will be detected by the blue precipitate immediately produced by ferrocyanate of potash preceded by acetic acid. A blue precipitate slowly formed may arise simply from reaction on the iron of the ferrocyanate. If much bitartrate of potash be present, the salt in powder will not be entirely soluble in twenty parts of water; but a test of much greater delicacy for this adulteration, so delicate indeed as to detect less than one per cent of it, and consequently to affect almost all the powders of tartar-emetic usually sold in the shops, is a strongly acid solution of acetate of lead, as suggested by M. Henry. When used according to the directions of the Edinburgh College, this test will not throw down the white tartrate of lead unless with the free tartaric acid of a bitartrate existing as an impurity. I have met with difficulties however in using this test which seem to me to render it too precarious for practice. ——Under the head of the adulterations of tartar-emetic it may be well to add, that it would be a great security to the retail druggist and apothecary against fraud, were he invariably to buy this salt in well-formed crystals; which may be easily had from every manufacturer, and which cannot contain any material impurity.

Actions and Uses.—Very few articles of the Materia Medica possess so great a variety of important actions or are susceptible of so many valuable applications in medical practice as tartar-emetic. It is an external irritant, and on this account a useful counter-stimulant. Internally it is an irritant, and therefore in large doses a poison, which may even prove fatal; and in medicinal doses it is a controstimulant, a sedative, an emetic, cathartic, diaphoretic, and expectorant.

As an external irritant it promotes suppuration from an ulcerated surface, and on this account is used with axunge as an issue-ointment. When rubbed into the skin in the form of ointment or solution, it peculiarly possesses the property of inflaming the substance of the true skin and bringing out a crop of pustules with inflamed bases; which remarkable property has led to its general adoption as a counter-irritant in many local inflammatory disorders both of the extremities and of internal organs. There is no end to the variety of its useful applications in this way. Pustules begin to appear commonly between two and five days after the first employment of the remedy. As white scars are left when they heal, those

parts of the body which are usually exposed, especially in females, ought to be avoided. When pustules are fully formed, the ointment should not be rubbed over or near them, as is often done; because troublesome ulceration may ensue or even sloughing in irritable habits. Caution is also advisable where it is used as an issue-ointment, otherwise the ulceration may extend inconveniently, or end in sloughing.

Internally, tartar-emetic is in large doses an irritant poison, which produces inflammation of the alimentary mucous membrane, and also, it appears, of the texture of the lungs by indirect action. But its effects in this respect are singularly uncertain, and in particular are apt to be suspended by some morbid states of the body, above all by the presence of general reaction, or internal acute inflammation. Its best antidote is any astringent decoction or infusion, which decomposes it and forms an insoluble tannate with the sesquioxide of antimony.——The same doses, which in the healthy state produce in general symptoms of irritant poisoning, unless speedily discharged by vomiting, appear frequently to exert a sedative or controstimulant action during the presence of general reaction or active inflammation. This method of using tartar-emetic, proposed by Dr Marryatt of Bristol in 1790, afterwards brought into celebrity by Rasori and others, and now well enough known in this and other countries, consists in administering one, two, three grains or more of tartar-emetic every two hours, commonly with some aromatic; and the effect, in active general or local reaction, is to lower the pulse and arrest local inflammation, without necessarily or even generally inducing any of the more familiar physiological effects of the drug which are presently to be mentioned, such as nausea, vomiting, purging, or sweating. This singular action, and the cure of pneumonia, pleurisy, and other acute internal inflammations through its means, are facts in therapeutics, to the truth of which, however much they were at one time doubted in this country, it is now almost unnecessary for any author to bear personal testimony. The diseases in which the controstimulant plan has seemed most beneficial are pneumonia, pleurisy, and erysipelas. I have seen little benefit from it in the late epidemics of continued fever. Likewise I must express my doubts whether the new controstimulant plan is superior in efficacy to the older method of administering tartar-emetic as a nauseating sedative and diaphoretic,—especially in the advanced stages of pneumonia and pleurisy. At times the large controstimulant doses do excite vomiting or purging, and even to a troublesome degree. The approved remedy in that case is augmentation of the doses, or suspension of them for twelve hours, or the addition of a little opium; but I have seen the vomiting and purging occasioned by the first doses so alarming as to render their abandonment indispensable.

The emetic action of tartar-emetic is elicited with the greatest

certainty by doses of one or two grains in a state of moderate dilution. The vomiting is not immediate, but commonly full, severe, and frequent, and accompanied with secretion of mucus from the stomach, gullet, and bronchial tubes, much sweating, and considerable prostration. Hence this salt is commonly preferred where it is thought advisable to produce strong succussion of the system, as for the arrestment of febrile diseases in their stage of formation. Being neither so immediate nor so certain in its effect as some other emetics, it is not now much employed in cases of poisoning; but in all other circumstances where mere evacuation of the stomach is the practitioner's object, it is in constant demand. On account of its want of taste when much diluted, it is one of the most convenient emetics for resolving the fit of hooping-cough by vomiting. From the extreme prostration which precedes vomiting, it is the best nauseating emetic to use in cases where difficulty occurs in reducing dislocations. In obstruction of the gullet from impacted food, it has been injected into the veins.

As a nauseating sedative, tartar-emetic is given in doses varying from an eighth of a grain to half a grain every two or three or four hours. Nausea may be thus kept up for a long time with little or no vomiting, and often with most remarkable effect in subduing general reaction and concomitant local inflammation. Its applications in this way are unbounded; but perhaps in no diseases are they so much to be depended on as in pneumonia, pleurisy, bronchitis, and erysipelas, and in the first two especially during the advanced stage. Frequently sweating accompanies the nauseant action,—not necessarily however, either as a mere occurrence, or for the therapeutic result. Perhaps the most extensively and positively useful of all the numerous actions of this drug is its action as a nauseating sedative and diaphoretic.

The powerful diaphoretic and sudorific properties of tartar-emetic may be developed without inducing nausea, and this in general by giving frequent small doses not exceeding an eighth or sixth of a grain. But those who wish to attain through this action any important therapeutic purpose must not shun too sedulously the induction of nausea or even occasional vomiting; for the sudorific action of antimonials is brought on with more certainty in concurrence with nausea; so that on the whole perhaps the best plan is to commence with nauseating doses, and reduce them when diaphoresis has been thus established. The diaphoretic plan is applicable in almost all circumstances where the nauseating method is available. Of the numberless febrile diseases where antimonial diaphoretics are prevalently given, the only one, where my own observation does not concur with that of most others as to their beneficial effects, is continued fever. After extensive experience as an hospital physician for twenty-five years, I must say, that I have seen no substantial reason for the warm commendations of this method of cure by some, either in the inflammatory

type put on by the disease in the earlier years of the period, or in the typhoid form which it has assumed more recently. What may have been, or may yet be, the case in other epidemics, it must be left to others to determine. In the late epidemics of Edinburgh I have seen no good done by it except as a palliative, and not a very trusty one, in abating reaction in the early stage of synochus and typhus.

The cathartic action of tartar-emetic is most apt to be induced when a moderate dose of half a grain or a whole grain is given much diluted. This is not one of its actions which is put to much practical use, unless when the salt is united with other cathartics, such more especially as the neutral salts; but in this way it constitutes an excellent refrigerant cathartic in most febrile diseases attended with brisk reaction.

As an expectorant, tartar-emetic has been given by many in very small doses of a sixteenth, a twelfth, or at most the eighth of a grain frequently repeated. But it proves a more sure and powerful expectorant,—for example in pneumonia and bronchitis,—when it is given either as a nauseant or diaphoretic, with a view more immediately to subdue inflammatory action. Should that effect be attained, improved expectoration speedily follows. Another way in which free expectoration is sometimes induced for a brief space and with good effect, in bronchitis particularly, is by administering a full emetic dose of the salt.

Of the various empirical applications of tartar-emetic, it seems unnecessary to say any thing in this brief outline of so comprehensive a subject; for none of them have fairly stood the test of time and the general experience of the profession.——Its use as an emetic in apoplexy is dangerous and obsolete,—in ophthalmia, questionable and almost forgotten,—for arresting the paroxysm of ague, undoubtedly sometimes successful, though far inferior to the method by sulphate of quina,—for promoting the eruption of exanthematic fevers, exploded,—as a sedative in mania, not generally approved of,—as an alterative in amaurosis, obscure and distrusted,—as an emetico-cathartic in colica pictonum, harsh, limited to French practice, and now getting out of fashion even there.

As a counterstimulant it is used in the form of the *Unguentum antimoniale* twice or thrice a-day. As a controstimulant or sedative one, one and a-half, or two grains may be given every two hours in one or at most two ounces of water, with some aromatic not astringent in its nature. As an emetic one grain should be dissolved in three ounces of water, and repeated after an interval of twenty minutes, if necessary. As a cathartic two grains may be dissolved with an ounce and a-half of Epsom salt in sixteen ounces of water, and three ounces or more given at intervals of one or two hours according to the degree of effect desired. As a nauseating sedative a quarter of a grain should be given in an ounce

or two of water, and repeated occasionally according to its effect; or three grains in a bottle of water may be taken instead of drink in four-and-twenty hours. As a diaphoretic and expectorant it should be given in the same way, but in less doses. Complex prescriptions, to give taste, odour, colour and so forth, are in the case of tartar-emetic worse than useless.

The officinal forms are *Antimonium tartarizatum*, E. (*Antimonii Potassio-tartras*, L. *Antimonii et potassæ tartras*, D.) gr. $\frac{1}{8}$ ad gr. iij. —*Vinum antimoniale*, dr. ss. ad fl. unc. i.—*Unguentum antimoniale*, E. *Unguentum antimonii potassio-tartratis*, L. *Unguentum tartari emetici*, D. externally.

AQUA, *E.* *Spring-water.*

TESTS, *Edin.* For pharmaceutic use spring-water must be so far at least free of saline matter as not to possess the quality of hardness, or contain above a 6,000th part of solid matter.

AQUA DESTILLATA, *L. E. D.* *Distilled-water.*

TESTS, *Edin.* Free of colour and odour: unaltered by sulphuretted-hydrogen or nitrate of silver, nitrate of baryta, or oxalate of ammonia.

PROCESS, *Edin.* Take any convenient quantity of spring-water; distil it from a proper vessel, rejecting the first twentieth, and preserving the first half of the remainder.

PROCESS, *Lond.* Take ten gallons of water; first distil two pints and reject them; then distil eight gallons, and keep the water in a glass vessel.

PROCESS, *Dub.* Take of water twenty pounds, and distil it, rejecting the first pound, and preserving the next gallon.

FOR. NAMES.—*Fren.* Eau.—*Ital.* Acqua.—*Span.* Agua.—*Port.* Agua.—*Ger.* Wasser.—*Dut.* Water.—*Swed.* Watten.—*Dan.* Vand.—*Russ.* Voda.—*Arab.* Mah; Owzir.—*Pers.* Ab.—*Tam.* Tanneer.

ALTHOUGH Water has been admitted into the Pharmacopœias in only two forms, other varieties are also currently used in medicine or pharmacy. The kinds commonly employed are six in number, Distilled-water, Rain or Snow-water, Spring-water, River or Lake-water, Mineral-water, and Sea-water. It will be necessary therefore to take some notice here of all those now enumerated.

Chemical History.—1. DISTILLED-WATER is the purest of all terrestrial waters, and is indispensable for some pharmaceutic processes, as well as for properly executing various prescriptions. In preparing it, the first portions ought to be rejected, as they are apt to contract impurities from the eduction-tube of the still or retort; and the distillation ought to be stopped before more than two-thirds of the water has passed over, because the organic matter which condenses on the sides of the vessel is apt to become charred by the heat, and so to supply a fresh source of impurity. When distilled in clean glass vessels, water is colourless, transparent, tasteless, and without odour. Owing to a deficiency of the usual gases held by it in solution, it has at first a mawkish flat insipidity; but this goes off after exposure for some time to the atmosphere. It is not affected by solution of nitrate of silver, nitrate of baryta, or oxalate

of ammonia,—tests, which are resisted by extremely few natural waters. When distilled from copper vessels it retains for some time a disagreeable metallic taste, which is particularly marked in what comes first over. But this taste passes away slowly under exposure to the air; the tests just mentioned are equally without action as on water distilled from glass; and the most delicate reagents do not indicate any metallic impregnation. It is very difficult to obtain distilled water absolutely pure, and not less so to preserve it in that state. A trace of organic matter obstinately adheres to it, or is gradually absorbed in time, however carefully the water may be preserved. These facts however are merely objects of scientific interest, and quite unimportant in reference to the practice of pharmacy.—Distilled water should be kept in glass vessels. The contact of lead with it must be carefully avoided; for the oxygen held in solution by the water quickly oxidates lead; the oxide is converted into carbonate by combination with the carbonic acid derived from the air; and the water comes to contain lead both dissolved, and suspended in a state of fine division (See the Author's Treatise on Poisons).

Distilled water has been thought by some theorists to be superior to every other kind as drink; and practical converts to the same doctrine have not been wanting, whose experience shows that at all events it is perfectly safe. It has not any acknowledged applications in medicine, but is extensively used in pharmacy. No other kind is admissible for dissolving pharmaceutic tests. Some salts, such as nitrate of silver and acetate of lead, cannot be so well dissolved for any purpose in any other kind, on account of the risk of partial decomposition from the action of other salts incidentally present. It is also generally the best of all for making vegetable infusions, because the presence of saline matter, even in small proportion, impairs the solvent power of water over many vegetable principles. In some situations where natural water of fine quality is seldom to be found, such as the middle and southern counties of England, the necessity for employing distilled water in pharmacy is frequent and indispensable; because the salts in many natural waters are so abundant, that they would vitiate numberless important processes. But in other quarters, for example throughout most of Scotland, where pure spring waters abound, the necessity for that which has been distilled is comparatively very limited.

2. Rain and Snow-water, when collected so as to prevent accidental impregnations, are the purest of all natural waters, and are distinguished from distilled water chiefly by their containing an unusual amount of atmospheric gases in solution. In order to obtain them pure however they must be collected at a distance from houses, and before coming in contact with the earth. At first water so collected is somewhat muddy owing to impalpable dust carried down by the rain or snow in passing through the atmosphere; but after subsidence or filtration, it is clear, transparent,

colourless, agreeable to the taste, sparkling, and unaffected by either nitrate of silver, nitrate of baryta, or oxalate of ammonia. Rain-water may also be obtained of nearly equal purity even in a great town by collecting with certain precautions what falls on the roofs of houses. The first water of a shower is very muddy, of a strong sooty taste and smell, and loaded with sulphates and muriates, as is shown, in the instance of Edinburgh at least, by copious precipitates being occasioned by acidulous nitrate of silver and acidulous nitrate of baryta. But if a few hours of a continuous shower be allowed to pass before beginning to collect the water,—it will be found, that the water, though turbid and sooty at first, becomes limpid and agreeable after filtration and exposure, and that it resists the silver and barytic tests, as well as oxalate of ammonia.

Rain or snow-water of the purity now adverted to is fit for every domestic use to which the finest spring waters may be applied. At one time indeed it was thought that snow-water tends to excite bronchocele; but this dogma ought now to be completely exploded. These waters too, when collected with due attention to ensure purity, may be applied to every purpose in pharmacy for which distilled water is commonly used.—I have found them to act upon lead with as great force as distilled water; a fact which must be attended to both in collecting and preserving them. Rain-water from leaden roofs must be used with caution if the roofs be new.

3. Spring-water includes in correct language all such waters as spring from the earth. But those waters are conventionally excluded from the list which either abound unusually in carbonic acid, or possess an elevated temperature, or contain so large a proportion of salts as to be unfit for domestic use. With these restrictions spring-water constitutes the general beverage of mankind, and for all other ordinary purposes is the most important variety of water. Those springs which arise from trap-rocks, sandstone, transition-rocks, and primitive rocks are the purest; those from alluvial strata, from beds of the coal formation with the exception of sandstone, and from limestone of all kinds, are commonly the least pure. All however contain a proportion of certain salts, the most general of which in this country are the muriates, sulphates and carbonates of lime, soda, and magnesia. The proportion varies exceedingly. The lowest proportion I have yet encountered was a 22,000th part of the water. If it exceed a 2,000th the water becomes scarcely fit for domestic use, and belongs to the class of mineral waters. In Scotland springs containing between an 8,000th and 12,000th are common. The water of this city sometimes contains the former amount of salts, but more generally approaches the latter. Oxalate of ammonia and nitrate of silver affect it; but nitrate of baryta and phosphate of ammonia do not do so, unless it be concentrated. It contains chiefly carbonate and muriate of lime and soda; and two-thirds of the solid ingredients consist of carbonate of lime. All spring-waters, however pure otherwise, contain some vegeto-animal

impregnation, which appears on evaporating a large quantity to dryness and then raising the heat; for the residual salts are brown at first, and become black at a low red heat. They are usually and conveniently divided into two qualities according to their amount of saline contents. Those which contain not above a 5000th are called soft, because they easily form a lather with soap and may be used for washing. Those which contain more, especially a 4000th or upwards, are termed hard, because they are comparatively destitute of these two properties.—Few spring-waters act like distilled or rain water upon lead,—the action being prevented by the salts they contain. The purer kinds of them however act slowly, so that they ought not to be kept long in leaden cisterns. In a few days no sensible impregnation is acquired; but in several weeks lead may be easily detected.

Spring-water is the proper and natural drink of man; but all kinds are not equally fit for use. The purer the water, the more is it wholesome; and when much loaded with salts so as to acquire the quality of hardness, it is apt to produce diarrhœa in those unaccustomed to hard water, in others a tendency to urinary gravel, and in others perhaps a liability to bronchocele. In pharmacy its uses increase in extent with its purity,—the purest being susceptible of universal application, and hard waters being almost useless. The Edinburgh College has alone admitted spring-water into the Pharmacopœia, but with the condition that it do not contain above a 6000th part of solid matter; and such water is properly directed to be used in many processes for which the two other Colleges direct that distilled water alone shall be employed. The College has been censured for so doing, on the ground that spring-water of such purity is rare. But no one would have made this criticism, who was acquainted with the hydrography of the country for which chiefly the Edinburgh Pharmacopœia is intended.

4. River-water and Lake-water differ from spring-waters in the following respects:—Having been long exposed to the air and much agitated, they contain less of the atmospheric gases, and are therefore flatter to the taste. In consequence of the escape of carbonic acid from them they commonly part with some of their earthy carbonates. And in their course over the surface of the earth and near human habitations they contract a great impregnation of vegeto-animal matter. According to the degree in which these sources of deterioration operate they vary much in purity. Some, like the rivers in northern Sweden, passing chiefly over primitive rocks and in desert regions, are so pure as to resist every chemical reagent, and to present only about a 40,000th of solid matter, which is principally organic in its nature. Others which pass through alluvial countries and near great cities, present as strong an impregnation of salts as hard spring-water, and besides abound so much in organic matter that they soon become putrid and

turbid on standing. It is important to observe, in reference to the practical uses of such waters, that river-water, which has become impure by passing through towns, manufactories, and the like, will in general purify itself in no long time during its course downwards, and will lose especially its vegeto-animal impurities. The cleansing process seems to be accomplished partly by oxidation of the organic ingredients, which thus become insoluble,—partly by a mutual action between the earthy salts of the water and the colouring matter and pectic acid contained in most herbaceous vegetables, in consequence of which action pulpy insoluble compounds are formed, to be separated afterwards by adhering to the sand and gravel in the bed of the river as it descends.

Lake and river waters, when moderately pure, are fit for all ordinary domestic purposes. If river water contain much vegeto-animal matter, it has been considered, not without strong reason, to be apt to engender endemic dysentery and other bowel affections; and such diseases are usually observed to be most virulent where water of this kind is habitually drunk. Their use in pharmacy is circumscribed by their degree of impurity. Those which contain much organic impregnation are inadmissible.

5. Mineral-waters comprehend in strict language such spring waters as present much carbonic acid, or a stronger saline impregnation than hard water, or a temperature above the mean heat of their latitude. But the term is more usually applied to all spring waters which possess qualities in relation to the animal body different from those of ordinary water used as drink; and in this sense it comprehends some which are remarkable for nothing else in regard to composition except extreme purity. The ingredients found in mineral waters, and upon the presence of which their effects on the body more or less depend, are caloric, free acids, alkaline carbonates, silica, neutral salts of the alkalis and earths, metallic salts, gases not acid in nature, and vegeto-animal matter. The free acids are sulphuric, muriatic, carbonic, and hydrosulphuric acids, especially the last two. The carbonate of soda is the only common alkaline carbonate. The neutral salts are sulphates, muriates and carbonates of lime, magnesia, soda, and alumina, occasionally with minute proportions of iodides and bromides, and other less important salts, such as nitrates, phosphates, borates, acetates and fluorides of the bases mentioned above, together with potash, baryta, lithia, and ammonia. The only important metallic salts are the sulphate and carbonate of iron; but traces of manganese are also sometimes met with, and more rarely traces of zinc. The gases not acid in nature are oxygen, azote, hydrogen, and carburetted-hydrogen. The vegeto-animal ingredients are humus-extractive, resin-extractive, and barègine. These multifarious ingredients are united in an infinite variety of ways, and thus occasion an exceeding variety in the physical qualities and physiological actions of mineral waters. All mineral waters however may be conveniently classified, in re-

spect to their physiological actions and therapeutic uses, according to the following arrangement, which is a modification of one proposed in 1832 by the late Dr Meredith Gairdner.

Dividing them in the first place into two series, Thermal and Cold springs, we may arrange the Thermal series in seven sections, —the Pure, Alkaline, Calcareous, Saline, Purgative, Siliceous, Sulphureous; and the Cold series may be arranged under six heads, the Acidulous, Alkaline, Saline, Purgative, Chalybeate, and Sulphureous. There are among thermal springs some which are acidulous or chalybeate, and among cold springs others which are pure, calcareous, or siliceous; but springs of these qualities have always other ingredients and corresponding properties, which are of primary consequence, and therefore determine their classification otherwise; and hence the two former are usually held to be wanting in the thermal, and the three latter in the cold groupe.

Thermal waters are all such as spring from the earth at a temperature higher than that of the mean latitude and altitude of the locality which produces them. They arise from a great depth in the bosom of the earth, and chiefly from rocks where the primitive and newer formations meet one another, or in the vicinity of traprocks, or where the newer stratified rocks show distinct signs of disturbance,—all of which geological localities clearly indicate the agency of subterranean fire. Of course they are also presented abundantly in the neighbourhood of existing volcanos or extinct craters. Their temperature varies from a few degrees above the mean of the latitude to the boiling point of water. The following are the temperatures of some of the most noted thermal waters in Britain and upon the continent: Matlock in Derbyshire, 68°; Buxton in the same county, 82°; Bristol in Somersetshire, 74°; Bath in Somersetshire, 117°; Wildbad in Bavaria, 95°; St Sauveur in the French Pyrenees, 90.2°; Pfeffers in Switzerland, 98°; St Nectaire in the south of France, 105°; Vichy in the south-east of France, 113°; Lucca in the dutchy of the same name, 113°; Teplitz in Bohemia, 118°; Cauterets in the Pyrenees, 130°; Barèges also in the Pyrenees, 112°; Ems in Nassau, 122°; Leuk in Switzerland, 123°; Aachen, or Aix-la-Chapelle, in Prussia, 144°; Baden in the dutchy of the same name, 147°; Wiesbaden in Nassau, 151°; Carlsbad in Bohemia, 165°; Ax in the French Pyrenees, 168°; Thuez in the Spanish Pyrenees, 171.5°; the spouting fountains of Geyser and Rykum in Iceland, 212°.—It has been thought that there is some peculiarity in the heat of thermal waters, compared with ordinary spring water similarly heated,—by reason of which the body, it is conceived, can bear them of a higher temperature and for a longer time. The fact however, which the hypothesis was intended to explain, is false; and equally erroneous (Longchamp) is the parallel statement, that thermal waters cool more slowly than an artificial water made in imitation of them.

Pure thermal waters, of which Matlock, Buxton, Wildbad, Pfef-

fers, and Aix-en-Provençe are among the most remarkable examples, are so free of salts and the other ingredients formerly specified, that their action on the animal body must depend mainly on their purity and their temperature. None of them contain above a 3,000th of solid ingredients. Matlock contains only a 10,000th.——There are no *Alkaline thermal* springs in Britain. The most celebrated upon the continent are the springs of Vichy and St Nectaire in France, and Ems in the dutchy of Nassau. In these, the carbonate of soda amounts to between twelve and thirty-eight grains in ten thousand of the water; and in the water of Vichy there is little else of saline matter. In all the alkali exists in the state of bicarbonate, generally with an excess of carbonic acid, which renders them sparkling, and imparts accessory properties to them as physiological agents. They are easily known by heat driving off carbonic acid and by the water then turning turmeric brown or reddened litmus purple.——Of *Calcareous thermals*, Bath and Bristol in England, and Leuk, Lucca, St Allyre, and Carlsbad on the Continent, are noted examples. The predominating ingredients are carbonate and sulphate of lime, often concurring with a little carbonate of magnesia. The most remarkable of these springs is St Allyre in France, where the calcareous matters are so abundant that objects immersed in the water become thickly encrusted in a few months. Most calcareous waters contain a sensible impregnation of carbonate of iron, which imparts to them accessory properties as chalybeates. They are known by an insoluble earthy precipitate being formed when they are boiled, and more especially when they are somewhat concentrated.—— *Saline thermals* are those hot springs whose chief ingredient is chloride of sodium. This salt, much as it abounds in springs of the cold series, is seldom abundant in the thermal groupe. Neither can it be said to impart to them their physiological character; for it commonly concurs with oxide of iron, whose operation is much more energetic and conspicuous. Baden-Baden and Wiesbaden are instances of saline thermals, which contain between 40 and 100 parts of solid matter in 10,000; and of this quantity about four-fifths are chloride of sodium. But both of them also contain oxide of iron. Saline thermals may be generally known by their pure salt taste and by the deposition of cubical crystals when evaporated nearly to dryness. ——*Purgative thermals* are not common. The salt which imparts the purgative property is chiefly sulphate of soda. St Gervais in Savoy is a characteristic example. Nearly one-half its solid contents, which amount in all to 50 in 10,000, consists of sulphate of soda. Such waters are known by their bitterness and by the tests to be presently mentioned for the salt they chiefly contain.——*Siliceous thermals,* though objects of great scientific interest, are not of any medicinal value. The spouting fountains of Geyser and Reikum, which are the most noted of them, contain about a thousandth of solid matter; which consists in a great measure of silica

held in solution by soda.——*Sulphureous thermals* are, medically speaking, the most important of all hot springs. They contain some free hydrosulphuric acid, which is given off upon boiling them; but their properties also depend in part, and often much more, on the presence of sulphuret of sodium and sulphuret of calcium. The most interesting sulphureous thermal waters in Europe are those of Aachen in Prussia, and more especially Barèges, Cauterets, St Sauveur, and many others, along the French side of the Pyrenees. Some of them, such as the water of Cauterets, contain half their volume of hydrosulphuric acid gas; and almost all of them present carbonate of soda as their most important accessory ingredient. There are not any sulphureous thermals in Britain. They are known by their peculiar odour. Free hydrosulphuric acid is detected by transmitting through solution of acetate of lead the gases disengaged from the water by ebullition; and sulphurets are discovered after prolonged ebullition by adding acetate of lead to the water. In either case a black precipitate is occasioned.

Cold Mineral Springs are all those whose temperature coincides with the mean heat of the latitude and altitude. They arise from every possible variety of geological formation; but the most remarkable of them present the same relation as the thermal series to volcanic agencies, existing, dormant, or extinct.——The *Acidulous springs* obviously arise deep in the bowels of the earth, and invariably present the geological relations just mentioned. They owe their characterizing properties to free carbonic acid, which sometimes amounts to twice the volume of the water and upwards. Few springs of this section however are purely acidulous. Other ingredients commonly exist in them, more especially carbonate of iron, carbonate of soda, or laxative salts; and these communicate important accessory qualities as physiological agents, or may be so abundant that the carbonic acid ceases to be the characterizing article, and becomes an accessory only. Many alkaline-acidulous, and chalybeate-acidulous waters are of the last description, and are therefore arranged under other sections of the cold series. Acidulous waters cannot be preserved without care, because their acid escapes quickly under exposure to the atmosphere. They differ considerably in this respect, the waters which also contain carbonate of soda or calcareous matters retaining their carbonic acid with more force than other varieties. All of them however may be kept long if very carefully bottled. They are in general easily known by their property of sparkling when poured into a glass, together with their freedom from any disagreeable odour,—or by the effect of heat in disengaging copious bubbles of a gas, which, when transmitted through lime-water, throws down a white precipitate of carbonate of lime. There are no springs in this country which contain so much carbonic acid as to be entitled to rank in the cold acidulous section. Many exist upon the Continent; among which the water of Selters in Nassau, Carlsbad in Bohemia, and the

Marienbrunnen at Marienbad also in Bohemia, are among the most famous. That of Carlsbad is very nearly a pure acidulous spring; the two others, although they contain oxide of iron, present it only as an accessory ingredient; and though the Marienbrunnen spring at Marienbad contains likewise a 200th of sulphate of soda, the purgative qualities it might in consequence possess are in a great measure counteracted by carbonic acid and iron. Perhaps the most remarkable acidulous water yet known is that of Saratoga in the State of New-York, which contains once and a third its volume of carbonic acid, and unites the accessory qualities of a laxative, chalybeate, and iodinous water. The waters of Selters and Saratoga are bottled in large quantity for preservation, the former to the amount of 1,200,000 quart-bottles annually. Both of them keep well. I have found the Saratoga water to preserve all its qualities undiminished after three years' keeping; and its carbonic acid was even somewhat above the proportion indicated by Dr Steel in the water taken directly from the spring.——*Cold alkaline* springs are such as owe their leading properties to the presence of bicarbonate of soda. They present the same geological relations to volcanic agencies as thermal and acidulous cold springs. They always contain an excess of carbonic acid, which imparts to them their most important accessory properties. They are known, after expelling the excess of carbonic acid with heat, by their alkaline taste and alkaline action on turmeric-paper. With proper care they may be preserved long unchanged, because the alkali renders the carbonic acid more fixed than in pure water. Britain possesses no alkaline waters worthy of the name,—Malvern, though commonly considered such, being in a correct classification a pure spring. They abound on the contrary upon the continent. Among the most noted instances are the springs of Vals in the French Department of the Ardêche, Tarasp in Switzerland, and Bilin in Bohemia. These contain each about a 200th or 250th of carbonate of soda; the first and last contain but a small proportion of any other solid matter; and all have about their own volume of free carbonic acid.——*Cold saline* springs, more commonly called *Brine* springs, owe their properties to chloride of sodium, and generally contain little else. They are commonly associated with the strata in which rock-salt occurs, often rise directly from rock-salt beds, but sometimes present, like the two previous sections, an intimate relation with the geological signs of volcanic agencies. No other variety of mineral water exhibits so great a concentration of its characterizing ingredient as the water of brine springs,—some being actually a concentrated solution of chloride of sodium. Many are nearly pure solutions; but not a few have been found to possess traces of iodine, bromine, or both together. They are at once known by their strong purely saline taste. England is richer in brine springs than almost any other country. The county of Cheshire and the adjacent parts of neighbouring counties present the

springs of Droitwich, Middlewich, Shirley-wich, Whealock, &c. where the water generally contains towards a fifth part of chloride of sodium, and very little else. Ashby-de-la-zouch in Leicestershire, a weaker brine spring, containing about a 60th of its weight of chloride of sodium, is an instance of the concurrence of bromine, which in the form of bromide of sodium constitutes a 16,000th of the water. And Salzhausen in Hessia presents a brine spring with a hundredth of its weight of chloride of sodium, and a 13,000th of iodine in union with the same base.——The *Cold Purgative* springs are all those whose prominent property is that of exciting increased action of the bowels; and they owe this property to the presence of certain neutral salts, among which the most important are sulphate of soda, sulphate of magnesia, and chloride of calcium. Purgative springs arise in various geological situations. Some proceed from strata of the coal formation, others from alluvial beds; but springs of great magnitude and strength generally arise near the junction of two different series of rocks, and not unfrequently near localities where stratified rocks have been disturbed by the ejection of trap. They may be conveniently arranged in three groupes according to the predominating salt. In the most powerful of them the principal purgative salt is sulphate of soda. Cheltenham and Leamington, and also, though in a less degree, Harrowgate present purgative springs of this nature; but the most remarkable spring of the kind yet known is that of Püllna in Bohemia, where the salts amount to a thirtieth of the water, and one-half of the saline ingredients is sulphate of soda. Others scarcely inferior to these owe their energy chiefly to sulphate of magnesia; of which the Epsom spring furnishes a good example, and the springs of Seidlitz and Saidschütz are still more characteristic instances. In the first of these sulphate of magnesia, to the amount of a 400th of the water, constitutes two-thirds of the saline ingredients. In the two continental springs the magnesian salt forms the same proportion to the total ingredients, but amounts to fully a hundredth of the weight of the water. In the spring of Püllna, where sulphate of soda abounds, the magnesian sulphate is also very abundant, its proportion to the water being about an eightieth. A third subdivision of purgative springs owe their virtues chiefly to chloride of calcium. The effect of this salt in imparting purgative qualities has not been sufficiently attended to. Nothing however can be more certain than that in the shape of a mineral water it is a very active agent in exciting the intestinal canal. For the three Scotch springs of Airthrey, Dumblane, and Pitcaithley, all in Perthshire, contain very little else than chloride of calcium and chloride of sodium; and the water of Airthrey, the strongest of the whole, and inferior in no respect to the strongest purgative waters of England, contains 127 grains of solid matter in 10,000, of which nearly 120 consist of equal parts of these two salts. Purgative springs may be known by their bitter saline

taste. Their particular composition is to be ascertained only by a careful chemical analysis. On this head it is sufficient to mention here, that sulphuric acid in combination is indicated by acidulous nitrate of baryta occasioning a white precipitate, and muriatic acid after this operation by acidulous nitrate of silver having a similar effect; that lime is indicated by oxalate of ammonia, and magnesia after this by phosphate of ammonia; and that, in the liquid from which lime and magnesia have been separated, soda is found, by first removing with acetate of lead the phosphoric acid of any excess of phosphate of ammonia, then removing any excess of lead with sulphuretted-hydrogen, and finally evaporating the liquid to dryness and incinerating the residuum, which will be carbonate of soda if there were any soda salts in the water, conjoined however with alumina if that earth be also one of the ingredients.——*Cold Chalybeate* springs are characterized by the presence of oxide of iron. The iron is held in solution either by carbonic or sulphuric acid. Four varieties must be distinguished on account of the diversity of their accessory effects on the body, viz. the Simple, Purging, Acidulous, and Aluminous chalybeates. The acidulous subdivision occur in the same geological situations with thermal, simple acidulous, and alkaline springs; the others are chiefly produced by alluvial strata, and sometimes by those of the newest formation. The quantity of oxide of iron in them is always small, except in the aluminous subsection. It is usually in the state of protoxide, but passes to the state of sesquioxide on exposure to the air. If the dissolving acid be the sulphuric, the water keeps well enough; but it is preserved with difficulty and imperfectly where the solvent is carbonic acid, unless the acid be in large excess. Chalybeates may be sometimes known by their taste. But a better indication is tincture of galls, especially after adding a little carbonate of soda; for a dark bluish-black precipitate is then at once occasioned, or appears in a few minutes. If a yellow or brownish precipitate be formed upon boiling the water, the ferruginous salt is the carbonate; if not, it is the sulphate. *Simple chalybeates* are those which have no accessory physiological properties in addition to their fundamental tonic action, and which are accordingly without either much free carbonic acid, neutral salts, or alumina. They abound in all countries. Tunbridge in Kent is a good instance of a simple carbonated chalybeate; Gilsland in Cumberland and Moffat in Dumfries-shire are characteristic instances of sulphated chalybeates. In these and other simple chalybeates the oxide of iron often does not exceed a 10,000th; it seldom surpasses a 2,500th; and the whole solid contents commonly fall short of a 1000th of the water. *Purging chalybeates* are such as contain one or more of the purgative neutral salts; and they are known by their saline bitterness, as well as by the tests given above for the purgative salts generally. England possesses some good purgative chalybeates, as at Harrogate, Cheltenham, and Leamington; where

the purgative salt is either chloride of sodium or sulphate of soda, in a proportion varying from a 300th to a 100th of the water; and where the oxide of iron varies from a 10,000th to so much as a thousandth (Leamington), which is an unusually high proportion. *Acidulous chalybeates* contain for their essential ingredients carbonate of iron with a large excess of free carbonic acid. The quantity of oxide of iron is usually very small, seldom indeed amounting to more than a 10,000th of their weight; but they often contain their own volume of carbonic acid gas and sometimes more. They cannot be preserved without great care in bottling them. They are known by their sparkling appearance when poured into a glass, their freedom from unpleasant odour, and the deposition of brown flakes when the carbonic acid is expelled by heat or long exposure to the air. Britain possesses no acidulous chalybeates; but there are many on the continent, among which Pyrmont and Spa in Westphalia, and Langenschwalbach in Nassau, enjoy most celebrity in this country. The Pyrmont water, perhaps the most remarkable in Europe, contains no more than an 18,000th of oxide of iron, with nearly twice its own volume of carbonic acid gas. That of Langenschwalbach, now more frequented since being patronized by the pen of Sir F. Head, has rather more iron, but only half the acid in the Pyrmont water. *Aluminous chalybeates* are characterized chemically by the presence of sulphate of iron and sulphate of alumina. They generally proceed from a decomposing alum-slate, and are not unfrequent as springs from coal-mines. They often contain a much larger portion of oxide of iron than any other chalybeates, a 300th part being not uncommon; and they are indeed sometimes so strong as to require dilution before they can be well made use of internally. They may be easily preserved for a long time with ordinary care. They are known by their ferruginous astringent taste, and by not undergoing any change when boiled; but still better by a process of analysis, which consists in throwing down the oxide of iron with an excess of solution of potash, and boiling the filtered liquid with muriate of ammonia. The excess of potash maintains the alumina in solution; and, on boiling the filtered fluid with muriate of ammonia, the muriate is decomposed by the potash, the ammonia is given off, the potash is neutralized by the muriatic acid, and the alumina separates in white flakes. This country abounds in aluminous chalybeates, among which may be mentioned those of the Isle of Wight, Beulah in Norwood forest, and Moffat in Dumfries-shire. That of the Isle of Wight, which has been long a place of resort, contains about a 600th of oxide of iron with as much alumina; that of Moffat has twice the quantity of oxide of iron; and there is another near Dollar in Clackmannanshire, proceeding from a deserted coal-mine, which is so highly loaded with iron as to have a deep reddish-brown colour and an intense acid astringent taste.——*Cold Sulphureous* springs, the last of the cold series, owe their properties to free sulphuretted

hydrogen. They arise chiefly from the rocks of the coal-formation, sometimes from alluvial beds, and often in the neighbourhood of chalybeate or purgative springs. The supply of water is seldom very abundant. The proportion of their characterizing ingredient is never great, some springs of much resort having scarcely a thirtieth of their volume of sulphuretted-hydrogen gas, and few in this country exceeding a tenth. In sulphureous springs of the cold series, this gas is free, and seldom, as in thermal waters, united with bases in the form of hydrosulphates or sulphurets. Such waters are sometimes simple; and sometimes they contain a sufficient amount of purgative salts to possess corresponding accessory qualities. They cannot be preserved without great care; but with due attention they may be kept for a long time with little loss of property. Sulphureous cold springs are known by their peculiar fetid odour, and by carbonate of lead being blackened when agitated with the water. Britain abounds in springs of this kind. Gilsland, Moffat, and Strathpeffer in the county of Ross are well known instances of pure sulphureous waters. The first contains only a fiftieth of its volume of gas, Moffat a thirteenth, and Strathpeffer, the strongest yet known in the island, a ninth. Leamington, Cheltenham, and Harrogate, which possess both purgative and chalybeate springs, have also fine sulphureous waters of the purgative kind. Harrogate presents the largest proportion of sulphuretted-hydrogen gas, namely a tenth of its volume, with a seventieth of its weight of chloride of sodium and a little sulphate of soda. Leamington water contains scarcely a thirtieth of gas, together with above a 300th of sulphate of soda. The water of Harrogate is often bottled to be sent to a distance, and may be kept sound for a considerable time. I have also found that with due care the water of Strathpeffer keeps tolerably well.

Actions and Uses.—The actions of mineral waters on the animal body are extremely interesting both in a scientific and practical point of view; but they are as yet ill understood, owing to the vagueness with which facts have been hitherto determined. Their effects are in some measure the same with those of the substances which form their leading ingredients. Nevertheless important differences are often observed; and these differences seem not always intelligible. We can easily understand that the operation of the leading ingredient must be liable to modification from the coexistence of accessory substances; for example, that the coexistence of purgative salts will modify the simple stimulant properties of an acidulous water, that iron will diminish the effects of a simple purgative one, and that an aluminous chalybeate will have very different effects on the bowels and general system from a simple, and still more from a purgative, chalybeate. It is also obvious that mineral waters, compared with the leading substances in them when given in artificial mixtures, possess a vast superiority as therapeutic agents through means of their adjuncts, a country atmo-

sphere, regular exercise, the amusements of society, and freedom from the cares of business. It seems likewise well ascertained that one remarkable peculiarity in their operation, namely their great activity compared with the small amount of their active constituents, may arise in part from the state of dilution in which these constituents exist, and in part also from several substances of similar properties being united together in the water. For it is well known that by attending to these two conditions the energy even of artificial preparations of the Materia Medica may often be considerably increased. But many entertain doubts whether all the circumstances here enumerated will account for every peculiarity observed in the action of mineral waters, more especially for their great energy. My own opinion is that, if dispassionately applied in explanation of apparent peculiarities, they will leave little to be accounted for; and that much of the supposed mystery in the operation of mineral waters is not inherent in the subject, but rather the result of mystification on the part of authors. At all events we now know that waters may be prepared artificially, which differ very little in their effects from the natural waters they are intended to imitate.

Mineral waters are always more active however than we should expect from the quantity of characterizing constituents they contain. They are thought less apt to disorder the stomach than artificial solutions. They are conceived to be most effectual when fresh, and even when taken at the spring, than when carried to a distance, however carefully they may be preserved. This proposition however admits of many exceptions. Simple purgative waters, acidulous alkaline waters, sulphated chalybeates, the water of brine springs, sulphureous thermals, and even simple sulphureous waters, may with proper care be both kept and carried without losing materially their energy. And if simple acidulous and chalybeate acidulous waters lose their properties more easily from keeping or carriage, no difficulty ought to be felt in accounting for it, since their carbonic acid obviously passes off, and their oxide of iron is precipitated.

Acidulous waters are powerfully and diffusively stimulant in their action; and they stimulate both the circulation and nervous system. Their effect is transient. The usual phenomena are determination of blood towards the brain, hilarity of spirits, and even some degree of intoxication in sensitive habits. They also possess a diuretic action. The carbonic acid increases materially the tonic virtues of chalybeates; but it rather impairs the energy of laxative salts. They are used in dyspepsia, in dropsy connected with a feeble and leucophlegmatic state of the system, in chronic diseases at large attended with diminished tone, in chlorosis connected with obstructed menstruation, and in phosphatic gravel. They are contraindicated in recent palsy or apoplexy, in the active hæmorrhagies, and in all acute inflammations.

Alkaline waters possess an antacid, antilithic, and diuretic action. As they invariably contain much free carbonic acid they also possess in some measure the stimulant effects of acidulous waters. But the stimulus is generally kept down by the action of the alkali, unless oxide of iron be likewise present in appreciable proportion,—in which case their tonic and stimulant operation is conspicuous. Alkaline waters constitute one of the best of all antacid remedies in dyspepsia connected with acidity. Through means of their antacid action they are also often of singular service in counteracting the gouty diathesis and removing the sequelæ of the gouty paroxysm. Their most important application is to the treatment of gravel and stone. An alkaline water, such as that of Vichy in France, often effectually corrects the tendency to lithic deposition in the urine,—a quantity equivalent to forty grains of bicarbonate of soda being sufficient to render the urine alkaline and free of deposit for four-and-twenty hours (D'Arcet). It even appears from late experiments and actual trial, that such waters may in no long time effect the solution or breaking up of middle-sized calculi of lithic acid in the bladder (Petit). And besides correcting the lithic diathesis, they likewise prevent phosphatic depositions through means of their excess of carbonic acid (D'Arcet). As diuretics they are sometimes useful in dropsy, especially when connected with an enfeebled state of the constitution.

Purgative waters are distinguished by uniting in an eminent degree cathartic and diuretic properties. When taken cold they are most apt to excite diuresis, especially if exercise be not practised afterwards. If moderately warmed and followed by a little exercise, their purgative effect is most generally developed. They seldom tend to enfeeble the stomach, like artificial laxative salts, but on the contrary increase the appetite for the succeeding meal, and accelerate digestion. They likewise seldom irritate the rectum or hæmorrhoidal tumours. Their purgative action, however effectual, is not apt to be followed by muscular debility or refrigeration of the body, as after ordinary saline cathartics. Neither do they tend to increase the necessity for their own employment, which is a serious objection to most other purgatives; for on the contrary it often becomes necessary to lessen the dose during a course of them. On account of these advantages purgative mineral springs are more frequented than other species. No remedy is more effectual in restoring the healthy action of the bowels when disturbed by dyspepsia or chronic diseases at large, or when rendered torpid by a sedentary occupation, or when disordered by the too frequent use of ordinary laxatives of the resinous kind. There is indeed scarcely any chronic disease, in which habitual constipation is a troublesome symptom, that may not be in some measure benefited by a course of some purging mineral water. The water of most purgative springs may be easily conveyed to a distance and long preserved in good order. Hence it may be usefully employed in the ordinary

course of practice,—as is familiarly known of the Harrogate water, and as I have likewise often experienced in regard to the powerful purgative water of Airthrey.

Chalybeate waters, as physiological agents, are chiefly characterized by their tonic action. They appear to possess this action in a more energetic degree than proportionally to the oxide of iron they contain; for half a grain of oxide of iron daily in the form of a chalybeate water is often a sufficient dose. As tonics they strengthen the pulse, increase the muscular tone, improve the florid colour of the blood, and diminish nervous irritability. In too large doses, or in sensitive habits they cause a sense of fulness in the head, flushing of the face, and a feeling of distension of the muscles of the limbs. They render the stools dark. They tend to increase the menstrual discharge, and are among the most powerful of emmenagogues. Their action as tonics is lessened by the coexistence of purgative salts; but these must be abundant to have such an effect, because conversely oxide of iron lessens the activity of laxative waters. Carbonic acid adds a powerful stimulant action to their tonic effects, and tends greatly to increase determination towards the head. The special diseases in which chalybeates are serviceable are dyspepsia connected with deficient tone, chronic cachexies of all kinds, especially struma, convalescence from severe chronic and acute diseases of all sorts, enlargement of the liver or spleen, particularly when originating in protracted agues or remittent fever, gout in its chronic stage or indolent forms, amenorrhœa when concurring with constitutional debility, chronic dysentery and diarrhœa. When used in dyspepsia, chalybeate waters must be preceded by the proper remedies for regulating the bowls; otherwise the intestinal functions directly, and those of the stomach secondarily, are apt to be still more disordered. And this object is generally secured by the preliminary use of a purgative spring, one of which is commonly to be found at every great chalybeate watering-place. In the chronic forms of gout it is of great consequence to unite an alkaline bicarbonate with the chalybeate; and hence the alkaline chalybeates are justly preferred for such cases. In chronic diarrhœa and dysentery aluminous chalybeates are the most serviceable, by reason of their powerful astringent properties. This description of mineral waters is contraindicated in local inflammations, in active hæmorrhagies, in commencing phthisis, in menorrhagia, or in habits inclined to that disease, but above all in persons subject to apoplexy, palsy, or determination towards the head, in whom the disagreeable effects of ferruginous remedies upon the brain and nervous system are developed with peculiar facility. Chalybeate waters never produce such good effects as when they are taken at the spring itself, partly because they are the least easily preserved of all mineral waters, partly because their efficacy depends very much on the

co-operation of free air, exercise, and the other adjuncts formerly mentioned.

The action of Sulphureous waters is stimulant, diaphoretic, diuretic, and emmenagogue. The stimulus is exerted upon the nervous system rather than upon the circulation, and is manifested chiefly by exhilaration and alertness. The stimulus is slight and transient, becomes more permanent where oxide of iron concurs with sulphuretted-hydrogen, and on the contrary is almost prevented by the concurrence of laxative salts. A diaphoretic effect is generally conceded to them, especially to the strong thermal sulphureous waters. Their diuretic tendency is unquestioned, and is much increased by the coexistence of neutral salts. There is also a general belief in their emmenagogue virtues. The usual physiological effects of such simple sulphureous waters as that of Moffat and Strathpeffer are exhilaration, improved appetite, and increased flow of urine. The special diseases in which they are chiefly beneficial are chronic rheumatism, chlorosis, with other constitutional consequences of disturbed menstruation, secondary syphilis, chronic cutaneous diseases, and dyspepsia generally, but in particular the forms connected with disorder in the functions of the liver. In all these diseases their activity is generally acknowledged. They are held to be contraindicated in plethora, determination to the head, and active hæmorrhagies. Sulphureous waters, like chalybeates, are most serviceable when drunk at the spring or near it, and lose much of their efficacy when transported to a distance, or when used without the patient leaving his residence and breaking up his old habits and manner of life. In general they require the preliminary use or concurrence of laxatives, because at first they seem rather to constipate the bowels. For most purposes it is advantageous to unite the use of the water in the form of bath with its internal administration. There is not a more efficacious way of treating old inveterate rheumatism, cutaneous eruptions, secondary syphilis, and dysmenorrhœa than by the combined internal and external use of a sulphureous thermal, such as that of Barèges, Cauterets, or Aix-la-Chapelle.

Little need be said of the other kinds of mineral waters as medicinal agents. Calcareous waters have been recommended by Dr Prout in diabetes, on the ground that they allay thirst better than ordinary spring-water. Siliceous waters are put to no use. Pure thermals can scarcely exercise any action on the body except as external agents; yet many people drink them, not without being sometimes rewarded for their confident hopes of amelioration. Saline springs cannot be expected to possess material therapeutic properties except as external agents. Several of them however, such as Ashby-de-la-zouch in Leicestershire and Salzhausen in Hessia, have been long resorted to for the treatment of goitre and the several forms of struma; and in all such waters it is remarkable

that analysis has recently indicated the presence of a little iodine or bromine in a state of combination.

In the preceding remarks on the medicinal use of mineral waters occasional allusion has been made to their employment in the form of bath. A few systematic remarks on this department of the subject may be here appended. The water of cold springs is seldom available for the purpose of a bath, because most of them cannot be heated without their intimate constitution being altered. Some however may be advantageously used in the form of cold-bath. Brine springs for example constitute an excellent substitute for sea-water. Cold sulphureous waters are not without use as topical remedies in cutaneous diseases. Cold alkaline baths may be likewise serviceable in diseases of the skin. Chalybeates are not generally employed as baths; but from their effects when used in this way, as at Langenschwalbach, it seems not improbable that their constitutional action as tonics may be thus obtained as well as by their administration internally. The oxide of iron at least enters the skin; as is shown by the linen being stained with ochrey spots if perspiration be brought on after the body is thoroughly cleansed and dried (Head.) Great advantage is derived from the use of thermal waters in the shape of bath. The effects of the ordinary warm-bath are here combined with the topical as well as constitutional action of their solid and gaseous impregnations. Alkaline thermals are serviceable in cutaneous diseases by their topical cleansing virtues and stimulant influence; saline thermals by their powerful topical stimulus are useful in the same disorders, and likewise as a branch of the general tonic regimen in debilitated states of the constitution; and sulphureous thermals seem to exert a specific stimulant action upon diseases of the skin. Alkaline and sulphureous thermals also probably act through the medium of absorption, the former in correcting the lithic diathesis, the latter in the cure of cutaneous diseases, rheumatism, amenorrhœa, and secondary syphilis. It must at the same time be confessed that it is very difficult to detach and appreciate these actions of thermal waters, amidst the phenomena they develope as curative agents by virtue of their temperature alone.

Attempts have been frequently made to obtain with the aid of chemistry factitious mineral waters, in imitation of those supplied by nature. For a long time no great success attended these efforts, because the analysis of mineral waters was too imperfect a branch of chemical art to furnish a correct account of their constitution. But since the method of analysis was perfected by the scientific inquiries of Dr Murray and the practical improvements of Berzelius and others, so that more accurate ideas were formed of the nature and ingredients of mineral waters, the efforts of speculators to fabricate imitations of them have been much more fortunate; and within a few years, through the activity of Dr Struve, extensive establishments for manufacturing them have been

formed in various parts of the continent, and also more lately at Brighton in England.' It is difficult to learn satisfactorily how far the experience of these establishments has realized the expectations upon which they were instituted. But Struve's factitious waters have been favourably spoken of by many, and they appear to deserve an impartial trial.

6. SEA-WATER, the last of the different kinds of water remaining for notice, is in some respects an important article of the Materia Medica; for it is one of the sources whence muriate of soda, as well as sulphate and carbonate of magnesia, is obtained, and it is also the most useful and familiar of the various sorts of baths. It has a strong saline, bitter, nauseous taste, and also, when collected near the shore, a faint, peculiar odour. Its temperature varies with the latitude and season, and sometimes with the period of tide, as well as with other circumstances which need scarcely be detailed here. Its density differs in different seas. On the British shores, excluding the obvious influence of terrestrial sources of dilution, it varies between 1027 and 1028.5. The proportion of its solid contents also varies considerably. A thousand parts of sea-water in the Baltic contain only twenty grains of solid matter, and in east winds only nine or even but five grains (Lichtenberg); in the Frith of Forth it contains 30.3 grains (Murray), at Boulogne 32, Hâvre 36, Bayonne 38, and Marseilles in the Mediterranean 41 (Bouillon-Lagrange and Vogel); and in the open Atlantic near the Canaries it is said to contain so much as 44 grains (Bergman). Its principal ingredients, according to Murray's view of the constitution of its salts, are in ten thousand parts 220 muriate of soda, 42 muriate of magnesia, 33.16 sulphate of soda, and 7.84 muriate of lime,—or, according to the analysis of the water of the Channel by Lagrange and Vogel, 251 muriate of soda, 35 muriate of magnesia, and 58 sulphate of magnesia. But there is also a small proportion of earthy carbonates and sulphate of lime, amounting in all to 5.5 grains in ten thousand of the Channel water, together with a minute quantity of potash-salts, a trace of iodine and of bromine, and faint traces of other unimportant matters. A very singular variety of sea-water, differing widely from that of the ocean, is that of the celebrated inland lake, the Dead Sea. This possesses the extraordinary density of 1211, contains twenty-five per cent of solid matter, and presents in ten thousand parts 1036 muriate of soda, 1024 muriate of magnesia, 392 muriate of lime, and 5 sulphate of lime (Marcet).

Actions and Uses.—Sea-water is in action an emetic and purgative. But it is little used for either purpose. In the natural state it is not an eligible purgative, because it is nauseous and apt to cause irritation in the rectum. When freed however of organic matter by filtration, and charged with four or five volumes of carbonic acid gas, it has been found a palatable and mild laxative (Pasquier). It is quite unfit for the drink of man; but fresh water may be

obtained from it of good quality either by congelation or distillation. Sea-water ice contains no saline matter, because the water in freezing detaches itself from its salts. Distilled water from sea-water has been supposed hurtful by some theorists; but frequent trial has proved its salubrity, if care be taken to reject the first product of the process.

In the form of bath sea-water has all the effects of the ordinary cold-bath, with the addition, that, owing to its saline contents, it exerts a more stimulant action on the skin than fresh water. Sea-bathing is the most grateful, salutary, and efficacious of all kinds of cold-baths. With some constitutions, in common with other forms of cold-bathing, it disagrees, because reaction does not readily take place afterwards, and protracted rigors, with coldness, lividity, tremors, stiffness of the muscles, debility, languor and drowsiness, usher in heat and restlessness at night, which, if the bathing be persevered in, may terminate in irregular fever, and will at all events result in emaciation and weakness. Where on the contrary sea-bathing agrees, it is followed soon by brisk reaction, a glow of the integuments, increased tone of the muscles, improved appetite and alertness of mind. In many instances, where it seems not to answer, the real cause is its excessive use, or the common prejudice, that it is necessary for safety to cool the body before going into the water. Sea-bathing is contraindicated by the presence of most visceral diseases, by cephalic disorders or general determination towards the head, by disordered menstruation or the presence of the menses, by tendency to dysentery or diarrhœa,—and generally by all circumstances in which mischief may arise from the sudden violent impression of cold upon the integuments being apt to induce determination inwards or internal congestions. In some of these circumstances the injurious effects are warded off by converting the cold-bath into a warm sea-water bath; which is often singularly serviceable in chronic visceral disturbance, disordered menstruation, and diarrhœa. Cold sea-bathing is resorted to in a great variety of cases, on account of its bracing or tonic effects, in convalescence from chronic diseases or tedious febrile attacks, in chronic cutaneous eruptions, and in indolent ulcers, enlargement of the glands, or diseased joints, connected with the strumous habit. In no affection is it more conspicuously or frequently useful than in the various forms of struma, especially in the young.

ARBUTUS, *D.* See *Uva-ursi.*

ARCTIUM LAPPA, *D.* *Seeds and Root of Arctium Lappa*, L. *Burdock.*

FOR. NAMES.—*Fren.* Bardane.—*Ital.* Lappola; Bardana.—*Span. and Port.* Bardana.—*Ger.* Klette.—*Swed.* Karrborre.—*Dan.* Agerborre; Storskreppe.—*Russ.* Lapushnik.

FIGURES of Arctium Lappa in Hayne, ii. 35, and as Arctium majus and Arctium minus in Nees von E. 225, 226, 227.

The Burdock was probably either the Αρκτιον or Αρκειον of Dioscorides.

The original species established by Linnæus under the name of *Arctium Lappa* has been since divided by some into two species, the *A. Bardana* and *A. Lappa*, and by others into three, *A. Bardana*, *A. majus* and *A. minus;* while others, following Decandolle, form a new genus for the medicinal plant, and term it *Lappa minor.* It is unnecessary to follow here these botanical refinements, because the drug produced by the plant is unimportant, and the properties of the whole allied species or varieties are identical. They all belong to Linnæus' class and order *Syngenesia æqualis*, and to the family of the *Compositæ* in Decandolle's natural arrangement, or the *Cynaraceæ* of Lindley. They are familiar natives of this country. The root is the chief officinal part of the plant, and it is collected from all the three species indiscriminately. It has a bitterish, somewhat acrid taste.

The root, leaves, and seeds have been esteemed as mildly diuretic, diaphoretic, and alterative; and the root in particular has had its day of celebrity as an alterative diet-drink in chronic cutaneous diseases, struma, chronic rheumatism, and secondary syphilis; in which diseases some liken it to sarsaparilla both as to the nature and degree of its effects. It is now however scarcely put to use in Britain. The proper form for administering the root of burdock is that of infusion or decoction.

ARGENTUM, *L. E. D.* *Silver.*

Tests, *Edin. Lond.* Entirely soluble in diluted nitric acid; this solution, treated with an excess of muriate of soda, gives a white precipitate entirely soluble in Aqua ammoniæ, and a fluid which is not affected by sulphuretted hydrogen. (Density, 10.4, *Lond.*)

For. Names.—*Fren.* Argent.—*Ital.* Argento.—*Span.* Plata.—*Port.* Prata.—*Ger.* Silber.—*Dut.* Zilver.—*Swed.* Silfwer.—*Dan.* Solf.—*Russ.* Serebro.—*Arab.* Fasseh.—*Pers.* Nokra.—*Tam.* Vellie.

Silver has been known from remote antiquity, but was little used in medicine till modern times.

Chemical History.—It is sometimes obtained native, but more generally from a variety of ores, in which it exists in the form of chloride or sulphuret, along with other metallic compounds, especially sulphuret of lead. As thus obtained, it is more or less impure; the ordinary silver of coins and silver plate is still more so, as it always contains an express addition of copper; and both frequently present a small admixture of gold, from which it must be purified to render it fit for the purposes to which it is applied in pharmacy. To effect this the impure silver is dissolved in diluted nitric acid, the solution precipitated with muriatic acid and the resulting chloride of silver, well washed with hot water. The chloride may then be decomposed either by projecting it in small successive portions into twice its weight of fused carbonate of potash, and subsequently raising the heat to fuse the silver, which on cooling

is found at the bottom;—or more conveniently by digesting it with potash-solution of density 1.25 till a black powder is formed entirely soluble in diluted nitric acid, and then washing and heating this powder, which is pure oxide of silver [Gregory];—or by digestion in contact with a plate of zinc, a few drops of sulphuric acid being added to accelerate the decomposition [Orchsie.] Pure silver is the whitest of the metals, possesses a high degree of brilliancy, and is permanent in the air, except that it tarnishes from the slow formation of sulphuret on its surface. Its density is 10.4, and when hammered, 10.5 or upwards. It may be cut with a knife, and is exceedingly ductile and malleable. It melts at a full red heat, reaching 940° according to Berzelius, but according to Daniell, 1873°. It unites with oxygen, chlorine, iodine, cyanogen, and sulphur. It forms salts with the acids, but is acted on only by nitric and sulphuric acids, and by the latter only with the aid of heat. Its compounds with other acids are formed by double decomposition.

Adulterations.—The impurities to which it is prevalently subject are gold, copper, and lead. Gold is indicated by a purplish powder being left after the solvent action of diluted nitric acid; lead by ammonia not dissolving entirely the chloride thrown down by an excess of chloride of sodium; and copper by sulphuretted-hydrogen causing a black precipitate in the solution from which the chloride of silver has been separated. The density, which has been added to these characters by the London College, is an inconvenient and unnecessary character.

Uses.—Silver is introduced into the Materia Medica merely for preparing the nitrate and cyanide of silver. As few substances attack it even at a high temperature, provided it be pure, it is used for making certain chemical apparatus. It was once much employed in pharmacy for silvering pills; but this practice is now almost abandoned in Britain.

ARGENTI CYANIDUM, *L.* *Cyanide of Silver.*

TESTS, *Lond.* Heat disengages cyanogen, and reduces it to silver.

PROCESS, *Lond.* Take of
Nitrate of silver, two ounces and two drachms;
Diluted hydrocyanic acid and
Water, of each a pint.
Dissolve the nitrate in the water, and add the hydrocyanic acid: wash the precipitate with distilled water, and dry it.

FOR. NAMES.—*Fren.* Cyanure d'argent.—*Ger.* Cyansilber.

THIS preparation is an unnecessary addition to the Materia Medica. It is put to no use except in pharmacy, for making hydrocyanic acid; and before it can be got, that acid must be obtained in some other way; for cyanide of silver is always prepared by precipitating nitrate of silver with hydrocyanic acid.

It is a heavy white powder. When heated in a tube it gives off cyanogen, as may be ascertained by the rose-coloured flame pro-

duced when the gas is set fire to; and metallic silver is left. It consists of one equivalent of each of its component parts, (CyAg), that is, 108 parts of silver and 26.4 of cyanogen. It is soluble in ammonia. It resists cold nitric acid; but when the acid is boiled on it hydrocyanic acid is given off, while the silver is oxidated, and at the same time dissolved to form a nitrate. The tests for its purity given by the London College are obviously calculated not to determine that point, but merely to settle its nature. Its most probable impurity is chloride of silver, which is detected by its not dissolving in boiling nitric acid.

ARGENTI NITRAS, *L. E.* ARGENTI NITRAS FUSUM, *D.* *Nitrate of Silver.*

TESTS, *Edin.* Soluble in distilled water, with the exception of a very scanty black powder. Twenty-nine grains dissolved in one fluidounce of distilled water, acidulated with nitric acid, precipitated with a solution of nine grains of muriate of ammonia, briskly agitated for a few seconds, and then allowed to rest a little, will yield a clear supernatant liquid, which still precipitates with more of the test.

TESTS, *Lond.* White, and blackened by light: entirely soluble: copper put into its solution throws down silver: other characters as stated under Argentum.

PROCESS, *Lond. Edin. Dub.* Take of
Pure silver, an ounce and a half (37 parts flattened into plates, and cut into pieces, D.)
Pure nitric acid, a fluidounce (diluted nitric acid, sixty parts, D.)
Distilled water, two fluidounces.
Dissolve the metal in the acid and water, with the aid of a moderate heat. Then gradually raise the heat till the water is all expelled; fuse the remaining salt in an earthen-ware or porcelain crucible, and pour the fused matter into iron moulds previously heated and greased slightly with tallow. Preserve the product in glass-vessels.

ARGENTI NITRATIS CRYSTALLI, D.

PROCESS, *Dub.* Prepare a solution of nitrate of silver as for the fused salt, but crystallize it by evaporation and cooling. Dry the crystals without heat, and keep them in glass and in the dark.

LIQUOR ARGENTI NITRATIS, L.

PROCESS, *Lond.* Take of
Nitrate of silver, a drachm;
Distilled water, a fluidounce.
Dissolve the nitrate in the water, filter, and preserve the solution in a well-closed vessel, and in the dark.

FOR. NAMES.—*Fren.* Nitrate d'argent; Pierre infernale.—*Ital.* Nitrato d'argento; Pietro infernale.—*Ger.* Silbersalpeter; Höllenstein.—*Russ.* Azotnokisloe serebro; *fused*, Litoe azotnokisloe serebro.

NITRATE OF SILVER (Lunar caustic; Lapis infernalis) seems to have been known to Geber in the eighth century.

Chemical History.—In preparing it, according to the process of the Pharmacopœias, by dissolving silver in diluted nitric acid, the solution is accelerated if the silver be in thin plates, or granulated by dropping the melted metal from a moderate height into water. Crystals may be obtained by evaporating and cooling the solution. The Dublin College recognizes the salt in this form; but unnecessarily, since the crystallized salt is well ascertained to differ in no essential respect from that which is fused. All the Pharmacopœias have a process for preparing the fused nitrate of silver, which is run into moulds to form it into rods or pencils for convenience in surgical practice. In making this preparation from the

solution care must be taken to drive off the whole water by a moderate heat gradually raised, till a clear liquid be obtained from which bubbles cease to be disengaged,—but not to raise the heat much higher, otherwise the salt will decompose and blacken. It is difficult however to prevent slight decomposition from taking place.

Nitrate of silver crystallizes variously in hexangular or rhombic tables or right rhombic prisms; which are transparent and colourless, very heavy, of an intense, persistent, bitter, metallic taste, permanent in the air, but subject to blacken under exposure to light, especially to the direct rays of the sun. When fused into rods it presents a grayish colour and radiated fracture, but differs in no other respect from the crystallized nitrate; which does not contain any water of crystallization as was once imagined. Nitrate of silver fuses at 426°; and about 600° it undergoes decomposition, oxygen and nitrous acid being given off, and the metal left in a state of purity. It is soluble in its own weight of temperate water, and in four parts of rectified spirit. Its best character in solution is, that it forms with muriatic acid or muriates a white curdy precipitate, which blackens under exposure to light, and is soluble in ammonia, but not in nitric acid, whether hot or cold. It blackens almost all organic substances with which it is placed in contact, and it corrodes the soft animal textures. Most organic matters in solution are indicated by it with extreme delicacy, a dark precipitate being gradually formed. Glass stoppers should always be used for the bottles in which it is kept; cork quickly decomposes it, especially in solution. When in rods it may be protected from injury and prevented from soiling the fingers by dipping it into melted sealing wax [Dumeril]. It is composed of one equivalent of oxide of silver and one equivalent of nitric acid ($AgO + NO^5$), or of 116 parts of the former and 54.15 of the latter.

Adulterations.—Nitrate of silver is subject to various adulterations, the chief of which are the nitrates of lead, zinc, copper, and potash; and in consequence of careless preparation it may likewise contain some free silver. The system of tests laid down by the London College will detect all these impurities except the most frequent of them. When the dissolved salt is precipitated by an excess of chloride of sodium, the precipitate is not entirely soluble in ammonia, if lead be present; and the liquid part gives with sulphuretted-hydrogen a white precipitate if there was any zinc, but a black one if there was any copper. As this method of examination will not detect the most frequent adulteration, namely nitrate of potash, the Edinburgh College has adopted an entirely different plan, which provides against all sorts of adulterations collectively, without indicating what in any particular case the nature of the impurity may be. This method consists in precipitating a given weight of nitrate of silver by such a quantity of a pure muriate as will throw down very nearly, but not quite, the whole silver in the form of chloride,—leaving, if the salt were pure, a small quantity,

which, after filtration, will precipitate with more of the test. The muriate of ammonia is preferred, because it is almost always a very pure salt. Of this salt 9.12 grains will exactly precipitate 29 grains of nitrate of silver. Hence if 9 grains of muriate of ammonia be added to that quantity of pure nitrate of silver, a farther addition of the test will cause farther precipitation. The data put down in the formula would allow about one per cent of impurity; which is above the average amount in good specimens. The only other common impurity,—namely free silver,—is almost constantly present on account of the difficulty of fusing the salt without a little of it being decomposed by too strong a heat; but the proportion ought to be very small. It is indicated by a black powder being left when the nitrate is dissolved in distilled water, and when abundant, by the rods presenting an unusually dark-gray colour on the surface of a fresh fracture. From what I have seen of the fused nitrate of silver of the shops, it may be suspected to contain nitre if it has a colourless fracture and is entirely soluble without any black powder separating.

Actions and Uses.— Nitrate of silver possesses corrosive, irritant, and tonic properties. The nature of its corrosive action has not been carefully studied, but the corrosion is accompanied with blackness of the part on exposure to light. As a corrosive it is a poison, but by no means an active one, because it is promptly decomposed by the chloride of sodium, mucus, and other animal matters, in the contents of the stomach. On account of its corrosive properties it is much employed as an escharotic for removing warts and other excrescences, and for repressing exuberant granulations upon sores; but its efficacy in these circumstances depends not so much on its corroding down the morbid structure, as upon its causing increased absorption and altered action. To its operation in this way, and not to its corrosive properties must also be ascribed the remarkable power now universally recognized in it by surgeons of altering the action of constitutional and other ulcers. By Mr Higginbottom and others the applications of this salt as a local stimulant in indolent and constitutional ulcers have been made very extensive and diversified. Perhaps it has been too warmly praised and too indiscriminately used; but it is well ascertained to be one of the best, if not the very best, of all local applications in the early stage of chancre, in mercurio-syphilitic as well as true venereal ulceration of the throat, and in ulcers of the cornea. No method of treatment more frequently or more quickly disposes these forms of ulceration to heal and cicatrize, than touching their surface with a solution of nitrate of silver or with a pointed rod of the salt. The author last mentioned has also strongly recommended the employment of it for the purpose of arresting external inflammation, more especially those forms of it which manifest a tendency to spread, such as erysipelas, erythema, and spreading cellular inflammation. The progress of the disease is said to be frequently

arrested by rubbing a moistened rod, or painting a strong solution of nitrate of silver, over the inflamed part and some portion of the adjacent sound skin, so as to encircle the inflammation. Nitrate of silver has also been found a useful local application in some chronic cutaneous diseases, and particularly in ringworm. In this class of affections it might probably be used with advantage to a greater extent. It is one of the topical remedies which have been supposed to possess the property of preventing the exulcerations and consequent scars produced by the pustular eruption of small-pox; for which purpose it is applied to the tops of the pustules before they are fully developed. A lotion consisting of two, four, six grains or upwards to the ounce is a favourite remedy with ophthalmic surgeons for removing specks from the cornea.

Internally nitrate of silver has been often used as a tonic. In epilepsy, it has been considered to be a powerful remedy of this kind; but it has gone rather out of fashion, since the attention of practitioners was called to an occasional and extraordinary consequence,—the communication of an indelible bluish-gray tint to the skin. Although cures seem to have been accomplished by its long-continued use, its success has not been such as to render it a favourite remedy in face of the risk of so annoying a result. It has also been tried as a tonic or antispasmodic in hysteria, in asthma and gastrodynia, though with doubtful advantage. Various authors of last century have recommended it strongly as a hydragogue cathartic in dropsy and in worms; there are not wanting modern writers who have repeated these recommendations; and it is said to be the basis of some nostrums for the treatment of the diseases in question.—The oxide has also been used internally as a tonic and antispasmodic. Very lately it has come into fashion, having been thought not liable to cause discoloration of the skin. This notion is at variance with the best established doctrines in general therapeutics; and accordingly I know one instance, and have been informed of others, where discoloration took place.

Nitrate of silver is given in doses varying from a quarter of a grain to two grains and upwards. Very discrepant accounts are given of its activity; which may probably arise from too little attention having been paid to the extreme facility with which this salt may be decomposed and rendered inert, by the secretions and contents of the stomach. On account of its very disagreeable taste it ought always to be given internally in the form of pill; which may be made with sugar, mucilage, bread-crumb, or extract of dandelion. Lotions of nitrate of silver are made of every possible variety of strength.

Its preparations and their doses are *Nitras argenti*, gr. ¼ ad gr. ii.; *Liquor argenti nitratis*, L. for external use.—It is also an important pharmaceutic test.

ARISTOLOCHIA SERPENTARIA, *D.* See *Serpentaria*.

ARMORACIA, *E. L.* COCHLEARIÆ ARMORACIAE RADIX, *D.* *Fresh root of Cochlearia armoracia* (*L. W. DC. Spr.*) *Horse-radish.*

INFUSUM ARMORACIAE COMPOS. L. D.

PROCESS, *Lond. Dub.* Take of
Horse-radish sliced, and
Mustard bruised, of each one ounce;
Compound spirit of horse-radish, one fluidounce;
Boiling water, a pint.
Infuse the horse-radish and mustard for two (six, D.) hours in a covered vessel; strain and add the spirit.

SPIRITUS ARMORACIAE COMPOS. L. D.

PROCESS, *Lond. Dub.* Take of
Horse-radish sliced, and
Dried orange-peel, of each 20 ounces;
Nutmegs bruised, five drachms;
Proof-spirit, a gallon;
Water, two pints.
Mix (macerate for twenty-four hours, D.) and then distil over a gallon.

FOR. NAMES.—*Fren.* Raifort sauvage.—*Ital.* Ramolaccio.—*Span.* Rabano rusticano.—*Port.* Rabaõ rustico.—*Ger.* Meerrettig.—*Dut.* Mierikswortel.—*Swed.* Pepparrot.—*Dan.* Peberrod.—*Russ.* Chren.

FIGURES of Cochlearia armoracia in Nees von E. 400. Hayne, v. 29. Steph. and Ch. ii. 114.

HORSE-RADISH is a very ancient remedy, being probably the Ραφανις αγρια of Discorides.

Natural History.—It grows freely in moist situations on the continent of Europe, and has been naturalized in this country, where it flowers frequently, but does not ripen its seeds. It belongs to the natural family *Cruciferæ* or *Brassicaceæ*, and to Linnæus' class and order *Tetradynamia Siliculosæ*. It has an annual stem and a perennial root, the latter of which is the officinal part. This varies between half an inch and two inches in diameter, and is sometimes two feet long. It is fibrous, fleshy, and succulent. When bruised it emits an acrid vapour, highly diffusible and penetrating, and which excites violent sneezing and secretion of tears. It has an exceedingly pungent taste, attended sometimes with sweetness, sometimes with bitterness, according to the soil and mode of cultivation. The root should be dug up in the autumn, as its acrimony is then strongest. It should be preserved fresh, in sand, in a damp cellar. Its properties chiefly depend upon an excessively pungent, acrid, diffusible volatile oil, which is yielded by the root in very small proportion. Dr Duncan estimates it at four parts in one thousand; but Gutret got scarcely a sixth part of that proportion. It communicates its properties both to water and alcohol, and passes over with either by distillation. It is believed not to exist ready formed in the unbroken root, but to be developed by the mutual reaction of its constituents when the root is bruised. The dried root is devoid of acrimony, and yields no volatile oil when distilled with water alone; but if white mustard be added, the property of yielding oil is restored, the myrosine of the mustard supplying the place of some necessary principle which is destroyed by desiccation [Simon.] The root contains in addition a little sugar, gum, starch and albumen.

Actions and Uses.—Horse-radish is a powerful stimulant and irritant, and is held by some to be also a useful antiscorbutic and a good diuretic. It is so irritating that it will redden and even blister the skin; and its volatile oil produces these effects swiftly. Many use it as condiment. The infusion has been commended as an antiscorbutic. The compound spirit is a warm stimulant, useful in some cases of dyspepsia, and as an addition to some mixtures for preventing their nauseating action. On the whole however this article of the Materia Medica might be expunged from the Pharmacopœias with little inconvenience.

The doses of its preparation are *Infusum armoraciæ compositum*, L. D. fl. unc. i. ad fl. unc. iv. *Spiritus armoraciæ compositus*, L. D. fl. dr. i. ad fl. dr. iv.

ARNICA MONTANA, *D.* *The flowers, leaves, and root of Arnica montana, L. W. DC.* *Leopard's-bane.*

FOR. NAMES.—*Fren. Span. and Port.* Arnica.—*Ger.* Wolverley.—*Dut.* Wolfswortel.—*Swed.* Hästfibler.—*Dan.* Wolverley.—*Russ.* Barannik gornoi.

FIGURES of Arnica montana in Hayne, vi. 47.—Nees von E. 239.—Steph. and Ch. iii. 123.

THIS plant is of modern introduction into the Materia Medica; and, after having been admitted into the British Pharmacopœias, has been recently allowed to drop from all but that of Dublin.

Natural History.—It is common on the Alps, and is met with also in the mountainous parts of the north of Europe. It belongs to the Linnæan class and order *Syngenesia Polygamia æqualis*, and to the natural family *Compositæ* of Decandolle and *Asteraceæ* of Lindley. The whole plant, but especially the root, possesses a peculiar aromatic, rather unpleasant odour, and a nauseous acrid taste. The root contains an acrid resin and volatile oil (Pfaff,) to which are owing its acrimony and aroma; and a bitter acrid principle, distinct from the resin, has been discovered in the flowers (Chevallier and Lassaigne,) and is the probable source of their physiological properties.

Actions and Uses.—If all be true which German writers say of the Leopard's-bane, it does not deserve the neglect into which it has fallen in Britain. It causes heat in the throat, nausea and vomiting in large doses (Jörg); and it has even been considered in some measure a narcotico-acrid poison, capable of producing inflammation of the alimentary canal, and coma. In small doses it accelerates the pulse, increases the perspiration, excites a flow of urine, and is also said occasionally to cause giddiness and headache. On account of these actions it has been esteemed in Germany as a stimulant in typhoid fever and other adynamic febrile diseases, in chronic palsy, and in amenorrhœa,—as a tonic in chronic rheumatism, and diseases of the bladder,—and as a diuretic and tonic in the asthenic forms of dropsy. The root is given in powder to the

amount of ten grains, or in the form of an infusion in thirty parts of water to the extent of an ounce, several times a-day. The flowers are given in the state of infusion made with eighty parts of water, to the extent of two fluidounces or upwards. They are said to cause irritation of the throat to a troublesome degree, and to be apt to excite vomiting, unless the down be prevented from getting into the infusion by tying the flowers in a linen bag before immersing them in the water.

ARSENICUM ALBUM, *E.* ACIDUM ARSENIOSUM, *L.* ARSENICI OXYDUM ALBUM SUBLIMATUM, *D.* *Arsenious acid; Sesquioxide of arsenic.*

TESTS, *Edin.* Entirely sublimed by heat.
TESTS, *Lond.* Entirely sublimed by heat; emits a garlick odour when heated with charcoal: soluble in boiling water; from which (when cooled) it is precipitated yellow by hydrosulphuric acid, and white by lime water.

PROCESS, *Dub.* Sublime the white oxide of arsenic by heat, in a proper vessel, avoiding the fumes.

LIQUOR ARSENICALIS, *E. D.* LIQUOR POTASSAE ARSENITIS, *L.* *Solution of arsenite of potass with excess of alkali.*

PROCESS, *Edin. Lond. Dub.* Take of
Powder of white arsenic, eighty grains (60, D.);
Carbonate of potash, 80 (60, D.) grains;
Compound tincture of lavender, (four, D.) five fluidrachms;
Distilled water, a pint (old wine m. D.)

Dissolve the white arsenic and carbonate of potash in half a pint of the water by boiling them in a glass vessel: Filter if necessary: Add the tincture when the solution has cooled, and then distilled water till the whole measures a pint.

FOR. NAMES.—*Fren.* Acide arsénieux; Arsenic blanc.—*Ital.* Arsenico bianco.—*Span.* Arsenico blanco.—*Ger.* Arsenichte saure; Weisser arsenic; Giftmehl.—*Dut.* Rottenkruid. *Swed.* Hwitt rättgift.—*Dan.* Rottekrudt.—*Russ.* Mischiakovistaia kislota; Beloi Mischiak.—*Arab.* Turab ul halic.—*Pers.* Sum ulfar.—*Tam.* Vullay pashanum.

THOUGH the native sulphurets of arsenic were familiar to the Greek and Roman physicians under the names of Αρσενικον or *auripigmentum* and Σανδαραχη or *sandaracha*, the more active oxide of this metal seems to have been unknown in Europe till the eleventh century, and the metal itself, though indicated by Paracelsus, was scarcely well defined till 1733, when Brandt accurately determined its nature and leading properties.

Chemical History.—Both the metal and its oxide occur in nature, either tolerably pure or in combination with other metals and metallic oxides. The oxide or white arsenic of the shops however is understood to be all obtained from the refuse found in the flues of furnaces where other metallic ores undergo the process of roasting, and more especially from the refuse of the roasting of the arseniuret of cobalt in the preparation of zaffre. The impure material from the flues is subjected to a second sublimation, and is thus obtained in a state of considerable purity. The product indeed, as

now found in the shops of this country, is so free from impurity as scarcely to require the additional sublimation once enjoined in all the Pharmacopœias, and still recommended by the College of Dublin.

The oxide, or rather sesquioxide of arsenic (White arsenic, Arsenic, Arsenious acid), when recently sublimed is in large masses, convex on one face, concave on the other, of a white shining appearance like porcelain externally, and often lined on its concave surface with crystals affecting the octaedral form. On breaking a large mass, it is often found to be quite transparent internally; but the transparent portion soon also becomes opaque and white, a change which is owing simply to a different molecular arrangement. Its density varies from 3.69 to 3.73, the latter being the density of the transparent, the former of the opaque variety. It is brittle and easily pulverized. Its taste is not acrid, as commonly alleged, but faintly sweetish; and it has no smell; but if left some time in contact with the mouth or nostrils it will cause much irritation. It sublimes at 380° F. without undergoing any change and without exhaling any odour; and it condenses in sparkling transparent crystals, which soon become opaque, and whose form is invariably the regular octaedre. When heated with carbonaceous matter it is reduced, and the metal sublimed; and the same reaction takes place when it is thrown upon some of the easily oxidable metals heated to redness. When thus subliming in the state of metal it emits a powerful alliaceous odour; and it condenses in the form of a brittle crystalline mass much resembling steel in colour and fracture. The metal under exposure to the air quickly tarnishes from oxidation, and forms a gray powder well known abroad, though little in this country, under the name of Fly-powder. When the metal is heated in close vessels it sublimes about the temperature of 356°; but if also in contact with atmospheric air, it is oxidated, passing to the state of white arsenic or arsenious acid, and crystallizing in that form in the upper part of the vessel. White arsenic is sparingly soluble in water. Temperate water takes up with difficulty about a 400th of its weight of the powder; boiling water dissolves about a ninth of its weight; and on cooling to 60° retains a 35th. The transparent variety seems to be less soluble than the opaque. The presence of organic matters lessens the solvent power of water. From a concentrated solution at 212° the oxide is deposited on cooling in small octaedral crystals, which may be increased to a considerable size by spontaneous evaporation. In this state it is permanently transparent. Oxide of arsenic is rendered more soluble in water by the concurrence of most acids. It is sparingly soluble in fixed oils. Strong nitric acid aided by heat converts it into an oxide of a higher degree of oxidation, the Arsenic acid. The sesquioxide is also considered an acid because it forms regular compounds with bases, of which those with the alkalis are soluble, those with the ordinary metallic oxides insoluble,

—and most of which are obtained by the way of double decomposition. It is a compound of two equivalents of arsenic and three of oxygen ($As^2 O^3$), that is, 75.4 parts of metal and 24 of oxygen.

The medico-legal relations of this substance are highly important, —more so perhaps than those of any other article used in medicine or the arts. Its medico-legal chemistry must therefore be touched on here; but it would be out of place to attempt more than a sketch of so comprehensive a subject. The following statement is therefore a mere summary of what the reader will find laid down in detail in my own and other works on Toxicology.

The metal arsenic, though poisonous in most of its compound forms, seldom becomes the object of medico-legal investigations except in that of arsenious acid, or white arsenic;—to which therefore what is now to be said will be confined.——The most common and most troublesome subjects of analysis are articles of food or drink, the contents of the stomach or intestines, or the tissues of these organs. In all cases, if any suspicious white powder can be detached, this must first be attended to. The remainder is to be boiled, distilled water being added if necessary; and the examination of the mixture thus obtained may be conducted in one of four ways.——1. The fluid after filtration is to be subjected in three distinct portions to the action of sulphuretted-hydrogen gas, ammoniacal nitrate of silver, and ammoniacal sulphate of copper. If arsenious acid be present in moderate proportion, sulphuretted-hydrogen throws down a sulphur-yellow sulphuret of arsenic; the silver test occasions a lemon-yellow precipitate of arsenite of silver; and the copper test precipitates a grass-green arsenite of copper. Should these three reactions be characteristically developed, the evidence of the presence of arsenic is unimpeachable. But the coexistence of organic matters, and of some inorganic bodies also, may prevent the action of all the tests except sulphuretted-hydrogen, which almost always acts if used with certain precautions. 2. The suspected fluid after filtration is to be acidulated with acetic or pure muriatic acid, subjected to a stream of sulphuretted-hydrogen gas, and boiled. If arsenious acid be present, the fluid will deposite, either immediately or after twenty-four hours' rest, a yellow precipitate; which is to be washed, dried, and reduced in a tube with black flux made by preference with dry carbonate of soda and charcoal. A brilliant ring will be sublimed, commonly crystalline on its inner surface; and this, when driven up and down the tube by heat, will become a congeries of white, sparkling crystals, with triangular facettes visible through a common magnifier. These crystals may be farther proved to be arsenious acid by dissolving them in boiling water, and applying to the cold solution the three liquid tests already mentioned. 3. The suspected fluid, without filtration, is put into a Döbereiner's lamp or some similar contrivance, and hydrogen gas disengaged from the fluid by means of zinc and sulphuric acid. After a quantity of gas has been collected,

it is to be burnt through a fine aperture in the exit-tube, and a plate of glass or porcelain held over the flame or in it. If there was any arsenic in the fluid, arseniuretted-hydrogen will form; and this being burnt along with the hydrogen, it will yield arsenic, which adheres to the plate, in the form of a bright metallic ring when the plate is held in the flame, and in the form of a white powder if the plate be held above. A more precise method is to pass the gas slowly along a narrow glass tube heated to low redness by a spirit lamp. A ring of metallic arsenic is deposited within the tube beyond the part which has been heated. The product may then be subjected to farther trial as in the method last described. This elegant mode of testing for arsenic, commonly known as Marsh's method, answers excellently in most circumstances. 4. The suspected substance being boiled with diluted muriatic acid, chips of copper-leaf, or copper-wire, are to be placed for a few minutes in the boiling liquid. The copper becomes tarnished with metallic arsenic, which may be detached, sometimes in the metallic form, more generally in that of crystallized oxide, by heating the copper in a fine tube. This process, an extremely delicate one, is the process of Reinsch.——The rules here laid down apply to all cases, even the most difficult. But where any of the arsenious acid can be detached in substance from the subject of examination, the process is simple and easy. All that is requisite is to reduce a portion directly with black flux, or to apply the three liquid tests to a solution of it.

It has been shown by Orfila, that in poisoning by arsenic the poison may be found throughout the tissues of the body, though it may not be detected in the alimentary canal. The organ in which the largest proportion is found is the liver; and it may be almost always detected there, except in cases of very rapid poisoning.

Adulterations.—The adulterations of white arsenic are unimportant. I have very rarely found more than an insignificant residuum, commonly of oxide of iron, when the ordinary article of the shops was subjected to sublimation. At all events the test of sublimation, of which alone the Edinburgh College makes use, is a sufficient criterion of its purity for medicinal use. The London College has annexed a variety of characters, such as its solubility in boiling water, its reduction with charcoal and heat, and the effect of sulphuretted-hydrogen and lime-water on its solution; all of which are tests for ascertaining its nature merely, and are of no use for ensuring its purity.——At one time this substance was often adulterated with gyps, chalk, and other cheap white powders; but these are never met with now-a-days. Should they happen to be present, sublimation will detect them.

The Liquor Arsenicalis, now incorrectly and unnecessarily termed by the London College *Liquor Potassæ Arsenitis*, has been arranged under the present head; because, although it contains a compound salt, the arsenite of potash, its chemical actions and phy-

siological properties are determined in a great measure by its arsenious acid. It approaches essentially in its composition to the Tasteless Ague-drop of Fowler; and consists of arsenious acid with excess of carbonate of potash, coloured, to prevent mistakes, with compound tincture of lavender. It has a strong alkaline reaction. It is best known by the action of sulphuretted-hydrogen; which has no effect upon it till the potash is supersaturated with some acid such as the muriatic or acetic; but which then occasions a dirty yellow precipitate composed of sulphuret of arsenic and colouring matter. It contains four grains of arsenious acid per ounce; from which however the Dublin College has in its last edition deducted a sixteenth part for some fancied reason of convenience.

Actions and Uses.—Arsenious acid is in large doses an irritant and in small doses a tonic; and by virtue of its tonic action it possesses febrifuge and alterative properties. As an irritant it is a poison, and a very powerful one, a few grains being adequate to occasion death. Its particular effects as a poison are extremely diversified. It produces, where it is directly applied, irritation and inflammation; which on the external surface of the body, especially on the surface of a sore, is commonly followed by sloughing; and which, when the poison is swallowed, gives rise to all the symptoms of acute inflammation of the alimentary mucous membrane. The other mucous surfaces are also often affected simultaneously, and in particular the mucous membrane of the genito-urinary organs. These local affections are always attended with extreme depression of the circulation; and sometimes the symptoms of this disorder are the only prominent features, so that death seems to take place from mortal faintness. A great multiplicity of secondary affections has farther been observed, among which the most frequent and most remarkable are partial palsy, epileptic convulsions, and dyspepsia with emaciation. The greater part of the effects now mentioned may be produced through whatever channel the poison has entered the body,—by the stomach, rectum, vagina, nostrils, cellular tissue, lungs, an ulcer, or even the sound skin; and in particular it is remarked, that, through whatever channel the poison is introduced, it is apt to excite inflammation of the alimentary canal and of the other mucous surfaces. It has been doubted whether any antidote exists for the poisonous operation of arsenic, and a great number of substances successively proposed as such have been in turn proved to be inactive. A strong case has been made out for the hydrated sesquioxide of iron, suggested a few years ago by Messrs Bunsen and Berthold; so that every druggist ought to have that substance in readiness (see *Ferrugo*). Notwithstanding what has been stated by some to the contrary, it certainly possesses the property, particularly in the state of pulp, but also when in dry powder, of removing every particle of arsenious acid from solution in water. It appears to act by forming an insoluble arsenite of iron, and about 12 parts are required to re-

move one of white arsenic [Maclagan]. Magnesia has been found by Bussy to act in a similar manner. It is most efficacious when recently precipitated in the gelatinous state from its sulphate by potash. The next best form is the light calcined magnesia of the shops; but the dense magnesia has very little action.

The tonic action of small doses of arsenious acid, like the action of tonic remedies in general, is scarcely marked by any physiological phenomena, and is chiefly shown by its secondary influence in subduing various morbid states of the animal system. When given continuously in very small doses for some time, the physiological effects commonly presented are some acceleration and increased hardness of the pulse, a sense of itchiness or prickling, with tenderness of the eyes, a silvery whiteness of the tongue, some swelling of the eyelids, and a livid circle round them, afterwards weakness of the stomach, tormina, or a sense of heat about the anus, and lowness of spirits. It does not appear whether the developement of these effects is essential to the establishment of the therapeutic effects which are usually referred to its tonic action. The reverse is commonly believed. But at the same time there can be no doubt that such physiological phenomena generally show themselves where it is successfully used as a therapeutic agent. They must always be attended to as the earliest signs of its poisonous operation, and as indicating therefore the necessity of suspending it.

On account of the properties adverted to, arsenious acid has long been much employed both as an external and an internal remedy. Externally it has been used chiefly in the several varieties of malignant ulceration, such as cancer, lupus, noli-me-tangere, and fungus hæmatodes, with the view of inducing healthy action. The usual effect is death of the part acted on and its subsequent separation by sloughing; after which a healthier surface may be for a time produced. Doubts are entertained however in the present day, whether any real advantage is ultimately obtained in true malignant ulceration; and the practice, from having been at one time very general, is now abandoned by British surgeons. A great variety of nostrums containing arsenic have been proposed for the purpose both by regular and irregular practitioners, among which may be mentioned the powder of Frêre-Cosme, the Pâte de Rousillot and Plunkett's paste; in all of them the only essential ingredient is arsenious acid, and it signifies very little what it is mixed with, provided it be not rendered insoluble by chemical combination. As good a mode of applying it as any other is to form it into an ointment with axunge, or into a paste with conserve of roses, thickened if necessary with powder of gum; and to add some powder of opium to allay the pain. Arsenical ointments and pastes ought not to be applied to a bleeding surface, otherwise absorption may ensue and formidable symptoms of poisoning. Absorption seems less likely to occur where a strong arsenical mixture is used, containing a tenth or even

a fourth part of its weight of arsenious acid, than when the weaker mixtures are applied which are made use of generally on the continent.——Arsenic has also been used as an application for the obstinate ulcers which sometimes occur at the roots of the nails. It is farther one of the remedies which have been most trusted to by some for arresting hospital gangrene. Dr Blackadder first strongly recommended it in this disease; and he used it in the form of Fowler's solution, which was applied by means of pledgets frequently renewed, until a dry slough covered the whole surface of the sore. Its employment as an external remedy for some cutaneous diseases, and for destroying vermin on the skin, cannot be approved of; for fatal accidents have in consequence not unfrequently resulted.

Internally arsenious acid has been principally resorted to for the cure of periodic intermitting diseases, such as ague, periodic neuralgia, and epilepsy. It was as a remedy for ague that it seems to have been first introduced currently into medical practice; and ever since the writings of Fowler towards the close of last century it has been generally regarded as a valuable febrifuge, second only to cinchona and its alkaloids in the power of arresting the paroxysms of intermittent. About eight days of treatment are sufficient for a fair trial of its virtues. The developement of the physiological phenomena, formerly mentioned as the first signs of its poisonous operation when given continuously in small doses, is not necessary to its febrifuge action. In periodic neuralgia arsenious acid has often proved a useful remedy, especially in intermitting headache. It is one of the standard remedies in epilepsy, and is perhaps fully as often successful as any other method of cure. But it is far from being so trustworthy as some maintain; and, since it must be continued a great length of time, troublesome effects are apt to accrue from its physiological operation. Among other phenomena in such circumstances desquamation of the cuticle, dropping of the nails, and falling out of the hair have been observed. I have known it serviceable in one instance, where these results occurred. Among the other diseases for which it has been used none require particular mention except chronic rheumatism and scaly cutaneous diseases. In that form of chronic rheumatism which is accompanied with firm swelling of the small joints of the hands, it is undoubtedly a useful remedy, as was first stated by Dr Haygarth; but it is of less service in the other forms of the disease. I have known several cases of this "nodosity of the joints," as some authors term it, get well under the continuous administration of arsenic for some weeks; and it appeared to me that the commencement of the cure concurred with the first developement of the physiological effects. In cutaneous diseases of the chronic kind it was strongly recommended by Mr Girdlestone, and it is now a staple remedy in some of the more obstinate species of scaly cutaneous disorders, such as lepra and psoriasis. It is less esteemed

in other skin diseases. Among the other special applications of arsenious acid may be here merely mentioned its employment in dropsy, syphilis, palsy, nervous tremor and chorea, scrofula, tetanus, and the effects of the bite of venomous snakes. In these affections it has been resorted to on the whole empirically and with doubtful advantage.

When administered internally, it is usually given in the form of the arsenical solution. Some have thought the arseniate of potash a more manageable preparation, and less apt to induce troublesome physiological effects; but there seems no good grounds for such preference. Very small doses must be given, not exceeding an eighth of a grain; and where it is judged necessary to push the remedy far, it is better to multiply the doses than to increase their amount, otherwise the stomach is apt to suffer. It has been advised to administer the doses after meals instead of before them, as is practised in regard to most other medicines; but dilution seems a more rational way of preventing any unpleasant immediate operation on the stomach. The first approach of the symptoms of its physiological action formerly mentioned must be diligently watched; and the doses must be suspended on their appearance. The best correctives when these symptoms have appeared, and the best preventive in a long course of arsenic, is a little opium, with the administration of nutritive food in small quantities at a time. ——Very large doses of arsenious acid have been given by some, such as a quarter of a grain and even onwards to an entire grain. But this practice is not worthy of imitation. The slight physiological effects occasionally developed by such doses have been probably owing either to idiosyncrasy or to the drug having been given with other substances which tend to blunt its action. Thus when the powder of arsenious acid is enveloped in charcoal-powder, it would appear to be rendered inert or nearly so, even although taken in poisonous doses, exceeding those now specified.

The officinal preparations of arsenic and their doses are: *Arsenicum album*, E. *Acidum arseniosum*, L. gr. $\frac{1}{10}$.—*Liquor arsenicalis*, E. D. *Liquor potassæ arsenitis*, L. min. v. to x. thrice a-day.

ARTEMISIA ABSINTHIUM, *D.* See *Absinthium.*

ARTEMISIA SINENSIS et A. INDICA, *D.* *Leaves of the Moxa plant of China.*

The Dublin College has adopted these two species of *Artemisia*, because, at the period of publication of the last Pharmacopœia of that College, they were believed to be used in China for preparing the inflammable cones, called Moxas, which not long ago had a temporary celebrity in this and other European countries, as a substitute for the actual cautery. It seems unnecessary to say any-

thing on this subject, however, in the present work. For in the first place, the moxa is now properly abandoned by most surgeons, in favour of the actual cautery as a more convenient, and less painful, remedy; then, the moxas used in Europe were never made of the leaves of the Chinese moxa-plant, which were not to be had in the drug-market, but of pith, cotton, and various other materials; and lastly, the Chinese moxa-plant is neither of the species indicated by the Pharmacopœia, but, as now appears, a distinct species with very downy leaves, the *Artemisia Moxa* of Decandolle.

ARTEMISIA SANTONICA, *D.* *The seeds of Artemisia Santonica, D.* *Worm-seed.*

The Dublin College is scarcely less in error in this than in the last reference. The plant from which the commercial substance, incorrectly called Worm-seed, is obtained has not yet been accurately traced. It has been referred to several species of *Artemisia*, such as *A. Contra*, *A. Judaïca*, *A. Austriaca*, and latterly by Batka to a new species from Palestine called *A. Sieberi.* Besides, the drug does not consist of seeds at all, but of undeveloped flowers, calyces, and fragments of peduncles. It is imported from Barbary and the Levant. The Levant kind is the more esteemed of the two, and is distinguished by being smooth and greenish, while the Barbary variety is grayish and downy. It contains a resinous extractive matter, and an acrid volatile oil, resembling peppermint in odour, to which its anthelmintic virtues have been ascribed; but according to M. Calloud its active principle is a white crystalline body Santonicin, possessed of acid properties [Peretti]. It is an old anthelmintic, once much esteemed in Europe, and still resorted to in domestic practice, though scarcely by regular practitioners. It is given best in substance in the dose of ten, twenty or thirty grains to children in the form of electuary, or along with milk; and a purgative should be administered after it has been taken for a few days (Duncan).

ASARUM, *L.* ASARI FOLIA, *D.* *Leaves of Asarum Europæum (L. W. Spr.)* *Asarabacca.*

Pulvis Asari Compositus, D.

Process, *Dub.* Take of
Asarabacca leaves, dried, one ounce;
Lavender, dried, one drachm.
Pulverize them together.

For. Names.—*Fren.* Cabaret.—*Ital.* Asaro.—*Span.* Asaro.—*Ger.* Haselkraut.—*Swed.* Hasselört.—*Dan.* Hasselurt.

Asarum europæum figured in Nees von E. 148. Hayne, i. 44. Roque, i. 38. Eng. Bot. 1083.

Natural and Chemical History.—Asarabacca, though one of

the remedies of the ancient physicians, and more or less employed ever since, has of late fallen so completely into disuse in this quarter, that the Edinburgh College has expunged it from the Materia Medica. It is produced by the *Asarum Europæum*, a small herbaceous plant with a perennial root, growing in moist hilly woods in England as well as in many parts of the continent. The plant pushes up only two kidney-shaped leaves, with a single bell-shaped, dingy-brownish-red flower. It belongs to the natural family *Aristolochiaceæ*, and to Linnæus' class and order *Dodecandria Monogynia.* The root and leaves are both officinal abroad; but the leaves are alone retained now in the British Pharmacopœias. Both seem to possess the same properties, the root however being the more energetic of the two. The root has a strong, not unpleasant, somewhat camphoraceous and peppery odour when dry, a less pleasant, valerian odour when fresh, and an acrid aromatic taste, followed for some time by numbness of the tongue. Its powder occasions severe irritation of the nostrils, copious discharge from them and frequent sneezing. Besides a variety of unimportant principles, it contains a crystalline substance, named Asarin, which has an acrid camphoraceous taste, fuses about 212°, volatilizes at a higher temperature in very acrid vapour, and excites nausea and vomiting when swallowed. The leaves of the plant present nearly the same sensible properties, but in a milder degree; and their chemical composition is the same, except that by distillation with water they yield an acrid volatile oil instead of a solid crystalline principle (Zeller).

Actions and Uses.—Asarabacca is a powerful emetic, and was much used as such in Europe before the introduction of ipecacuan. It is also a cathartic, and was once considered a diuretic, diaphoretic and emmenagogue. The chief use now made of it is as an errhine in the composition of cephalic snuffs; of most of which it forms a part. A few grains of the powdered leaves snuffed up the nostrils will keep up a discharge, attended with sneezing, for several days; and this treatment is sometimes serviceable in headache and chronic ophthalmia. The alcoholic extract of the leaves is said to be emetic only, the infusion cathartic in a great measure, and the decoction by prolonged boiling diaphoretic and diuretic.

ASSAFOETIDA, *E. L. D. Gummy-resinous exudation of Ferula assafœtida, L. W. DC. Spr., and probably (Edin.) also of Ferula persica, W. DC. Spr. Assafœtida.*

EMPLASTRUM ASSAFOETIDAE, E.

PROCESS, *Edin.* Take of
Litharge-plaster, and
Assafœtida, of each two ounces;
Galbanum, and
Bees' wax, of each one ounce.

Liquefy the gum-resins together, and strain them; then add the plaster and wax, also in the melted state; and mix them all thoroughly together.

MISTURA ASSAFOETIDAE, L. D.

PROCESS, *Lond.* Take of
Assafœtida, five drachms;
Water, a pint;
Triturate the assafœtida with the water, gradually added, so as to form an emulsion.

PROCESS, *Dub.* Take of
Assafœtida, one drachm;
Pennyroyal water, eight fluidounces;
Triturate the assafœtida with the water, gradually added, so as to form an emulsion.

PILULAE ASSAFOETIDAE. E.

PROCESS, *Edin.* Take of
Assafœtida,
Galbanum, and
Myrrh, of each three parts;
Conserve of red-rose, four parts, or a sufficiency.
Mix and beat them into a proper pill-mass.

PILULAE GALBANI COMP. L. D.

PROCESS, *Lond. Dub.* Take of
Galbanum, one ounce;
Myrrh, and
Sagapenum, of each an ounce and a half;
Assafœtida, half an ounce;
Syrup (Treacle, D.) a sufficiency.
Beat them together into a uniform mass.

PILULAE ALOES ET ASSAFOETIDAE, E.
See *Aloë.*

ENEMA FOETIDUM, E. D.

PROCESS, *Edin. Dub.* Add two drachms of tincture of assafœtida to the Enema catharticum. See *Magnesiæ Sulphas.*

TINCTURA ASSAFOETIDAE, E. L. D.

PROCESS, *Edin. Lond.* Take of
Assafœtida, in small fragments, five ounces;
Rectified spirit, two pints.
Digest for seven (fourteen, L.) days, and filter the clear liquor.
This tincture cannot be made by percolation without much delay (Edin.)

PROCESS, *Dub.* Take of
Assafœtida, four ounces;
Rectified spirit, two pints (old m.);
Water, eight fluidounces.
Triturate the assafœtida with the water: add the spirit: macerate for seven days, and filter.

SPIRITUS AMMONIAE FOETIDUS, E. L. D.

PROCESS, *Edin.* Take of
Spirit of ammonia, ten fluidounces and a half;
Assafœtida, half an ounce.
Break the assafœtida into small fragments; digest it in the spirit for twelve hours; distil over ten fluidounces and a half by means of a vapour-bath heat.

PROCESS, *Lond.* Take of
Hydrochlorate of ammonia, ten ounces;
Carbonate of potash, sixteen ounces;
Rectified spirit, and
Water, of each three pints;
Assafœtida, five ounces.
Mix them and distil off three pints with a gentle heat.

PROCESS, *Dub.* Take of
Spirit of ammonia, two pints (old m.);
Assafœtida, an ounce and a quarter.
Macerate in a close vessel for three days, agitating occasionally; pour off the clear liquor; distil one pint and a half.

FOR. NAMES.—*Fren.* Asa-foetida.—*Ital.* Assafœtida.—*Span.* Asa fetida.—*Port.* Assafetida.—*Ger.* Stinkasant.—*Dut.* Duivelsdreck.—*Swed.* Dyfwelsträck.—*Dan.* Dyvelsdrek.—*Russ.* Asafetida; Durnopachutschnik.—*Arab.* Halsiit; Andjudaan.—*Pers.* Ungooseh; Hingisch.—*Tam.* Perungyum.—*Hind.* Hing.

FIGURES of Ferula Assafœtida in Kaempfer 536.—Nees von E. 293. As Narthex Assafœtida in Royle's Mat. Med. figs. 69, 70, 71.—Of Ferula persica in Phil. Trans. lxxxv.—As F. Assafœtida in Roque, 109.

ASSAFŒTIDA is believed to have been the exuded juice of the Σιλφιον of Dioscorides, and was much prized by the Greek physi-

cians. The derivation of its modern name of *assa*, often also written, *asa*-fœtida, is probably from Assa, the Persian word for a staff or cane. It has been understood since the time of Dioscorides to be produced in Persia. But no scientific or detailed information was possessed in Europe respecting its source, till Kaempfer visited in 1687 the territory which produces it, and witnessed the mode of preparing it.

Natural History.—It is probable that assafœtida is obtained from at least two distinct species of plants. One of them was found growing by Kaempfer in the province of Laristan towards the Persian Gulf, not far from Gambroon; and the same plant was also stated to him to grow on the eastern confines of Persia in the province of Khorasan, near Herat. It has been repeatedly seen since then in these and other localities by Europeans.——In 1839 seeds of the Herat plant were received in this country from Sir John M'Neill, who visited the district and saw the plant growing. In 1838 Dr Falconer saw the same plant growing in the valley of Astore to the north of Cashmere, and afterwards cultivated it in the Saharunpore Botanic Garden. In 1840 another locality was found by the expedition of Lieutenant Wood to the sources of the Oxus. This is situated in Syghan, near the western termination and on the northern slope of the Hindoo Coosh range of mountains, about twenty miles north of Bameean. From the description of Kaempfer the assafœtida plant belongs to the *Umbelliferæ* in Natural arrangements, and to Linnæus' class and order *Pentandria Digynia*. Linnæus arranged it in the genus *Ferula* under the name of *F. Assafœtida*. But Dr Falconer considers it to belong to a distinct genus, to which, after an elaborate examination (see *Royle's Materia Medica*), he has lately given the name of *Narthex*. The *Narthex Assafœtida* has a long, generally undivided root, black without, but internally white, fleshy, full of juice, and of an overpowering odour, somewhat like that of garlic. This root when about a year old attains the thickness of the thumb, and continues afterwards to increase until it shoots up a flowering stem, so that it sometimes equals at last a man's calf or even his thigh in size. It pushes out annually several large root-leaves, which resemble those of the pæony, and exhale a strong garlicky odour, like that of the root, but weaker. Rarely in its first year, generally indeed not till it is many years old, it produces a flowering stem, which is between six and nine feet tall, about two inches in diameter, and naked, except that it bears rudimentary leaves in the form of the cylindrical bases of leaf-stalks. The whole plant dies after it has once flowered and ripened its seeds. It grows generally in a dry sandy soil, in Laristan, Cashmere, and Syghan among hills, but near Herat upon plains. Dr George Grant, who accompanied Lieutenant Wood's expedition, informed me, that the Syghan plant which is called by the Syganchees Angooza, attains a height of four, five, or six feet, and its root, leaves, and flowering stem cor-

respond on the whole with Kaempfer's description, except that the root is "deeply divided like the outspread hand." The plant has not yet been fully reared in Europe. Seeds sent both by Sir John M'Neill and by Dr Falconer to the Edinburgh Botanic Garden were sprung in 1842 by our skilful superintendent, Mr Macnab. In that year the shoots merely appeared above ground, seemed to die, and were given up as lost. But next summer several specimens re-appeared, and they are now vigorous thriving plants. Their leaves which are of great size and answer exactly to the descriptions of Kaempfer and of Falconer, appear in spring, and die soon after midsummer. One of the roots is now three inches and a half in diameter at the crown; so that it may be expected to flower soon.

It has been thought that assafœtida is sometimes produced like ammoniac, in the form of tears upon the stem of the plant, subsequently to pricks made by the proboscis of a sort of beetle. This however is denied by Kaempfer; who describes it as being always obtained in the following manner. When the plant is at least four years old, and before it produces a flowering stem, the root-leaves are twisted off close to the root in the beginning of April; and the soil is removed from the crown of the root. About forty days afterwards a slice is cut horizontally from its summit; upon which a milky juice of an overpowering fetid odour gradually exudes. In two days when the exudation is somewhat hardened, it is scraped off, and at the same time a fresh slice is cut off the top of the root, from which the juice again flows, and is collected as before. This process may be repeated so often as twelve times in the course of six weeks, before the root is altogether exhausted. The gum-resin gathered from several plants at one time, is united into masses about one or two pounds in weight; and when farther hardened by keeping, it is sent to the ports of Persia for exportation, or disposed of for consumption in the country as a condiment. I am informed by Sir John M'Neill that this description applies exactly to the present mode of collecting assafœtida near Herat; and Dr Grant stated to me that a similar method is followed in Syghan, where however the slicing of the root is not repeated above six or seven times.

There seems little doubt that assafœtida is likewise obtained from a species different from that of Kaempfer and inhabiting the northern parts of Persia. A root of this species was sent to Edinburgh by Pallas from the mountains of the provice of Ghilan, in the north-west of the kingdom; and the plant having sprung in the Botanic Garden here, it was described by Dr John Hope in 1783 as the true assafœtida plant (Phil. Trans.) This species, named by Willdenow *Ferula persica*, has been long propagated successfully in Britain, and thrives tolerably and even ripens its seeds in this climate. It does not exceed three feet in height, produces a branchy stem, and bears tripinnate or quadripinnate, delicately

divided root-leaves;—in all which respects it differs from Kaempfer's plant. Like that species however, its stem presents rudimentary leaves; and every part emits when wounded a milky juice possessing exactly the taste and odour of the assafœtida of commerce. The statements of Hope have been confirmed by a Russian traveller M. Szowitz, who discovered the plant in the Steppes near Nukhchiwan (Decandolle, Bibl. Univ. 1829). And I am informed by Sir John M'Neill, that there can be no doubt of a species of assafœtida, inferior in quality to that of Herat, being produced in the north of Persia from a plant corresponding in characters with Willdenow's *Ferula persica.* Dr Falconer and Dr Royle are of opinion that various species may yield a kind of assafœtida, but that the fine sort, brought to this country, is all the product of *Narthex Assafœtida.* This statement seems highly probable.

Chemical History.—Assafœtida is met with in the shops in two forms, in tears and in lumps. The tears, which are not often seen in European commerce, vary in size from that of a pea to that of a large almond. They are roundish, oval, or irregular, and commonly flattened,—yellowish-white externally, but milk-white within, passing gradually to a fine rose tint under exposure to the air,—brittle and pulverizable in cold weather, but easily softened with the heat of the hand. But the greater part of the assafœtida of commerce occurs in lumps, from half a pound to two pounds and upwards in weight. The lumps have an irregular amygdaloid appearance externally as well as internally, being composed of irregularly-shaped firm tears agglutinated by a softer substance. In the best qualities the tears are glued together with a small proportion only of the connecting matter; in which case the lumps are of a mottled yellowish, brownish-yellow, and rose-red colour externally,—milk-white internally passing slowly to rose-red under exposure to the air,—somewhat cellular owing to interstices between the component tears,—brittle at ordinary temperatures, but easily softened by the heat of the hand;—in short they possess in a great measure the characters of tears simply adhering together. In the inferior sorts the tears are few in number, and the agglutinating material abundant; and then the outer surface presents rather a brownish-red hue,—the surface of a fresh fracture shows fewer milk-white patches, and a greater extent of brownish matter, which does not acquire so fine a rose-tint under exposure,—and the whole consistence of the lumps is softer, so that the finger makes an impression on them even at common temperatures. Every sort of assafœtida has a powerful penetrating odour somewhat like that of garlic, and a strong, peculiar, bitterish, rather acrid taste.

Its qualities are best preserved by wrapping it in bladders; which should be kept in tin-boxes or close drawers. Under long exposure to the air it loses much of its fetid odour and becomes less fit for medicinal purposes. It cannot be pulverized except in frosty

weather, and its powder is apt to cohere again. A moderate heat softens it so far that it may be squeezed through a coarse cloth; by which means it is sometimes freed of mechanical impurities. A stronger heat causes it to froth up; and at a red heat it takes fire and burns with a white flame. The effects of simple solvents on it are such as may be anticipated from its component parts, which are principally resin, gum, and volatile oil. Water, cold or warm, dissolves the gum, forming a mucilage in which the resin and volatile oil may be suspended. Hence assafœtida makes a smooth emulsion with water without any addition. The *Mistura assafœtidæ* of the London and Dublin Colleges is made in this way; for the pennyroyal-water substituted by the latter College for simple water has no other effect than to add an aromatic to the assafœtida. Spirit dissolves chiefly the resin and oil, but also some of the gum; and the proportion of the latter to the resin diminishes as the strength of the spirit increases. Rectified spirit is best therefore for making the *Tinctura assafœtidæ*; because proof-spirit, the usual menstruum for officinal tinctures, is too feeble a solvent to yield a strong solution. This is one of the tinctures which cannot be so conveniently made as others by the method of percolation. A percolated tincture however may be obtained by macerating fragments of assafœtida for twenty-four hours in a fourth part of the spirit, throwing the whole into a percolator, and adding fresh spirit as soon as the first infusion has passed through. The process is tedious; but the crude material is thus entirely deprived of resin and volatile oil with the officinal proportion of rectified spirit. The tincture becomes an emulsion when thrown into water, owing to separation of its resin. An extemporaneous *Enema fœtidum* is thus very conveniently made either with water alone, or, as the Pharmacopœias direct, with the addition of the oil and sulphate of magnesia used for making the Cathartic injection. Sulphuric ether dissolves the volatile oil and most of the resin, leaving all the gum and towards two per cent of a different kind of resin untouched. Solution of caustic potash dissolves assafœtida almost entirely; and an emulsion is formed when the alkali is neutralized. Solution of ammonia also in part dissolves the resin along with the gum and oil. When water or spirit is distilled from assafœtida, a volatile oil passes over with the distilled fluid, both in a state of solution, and likewise, in the case of water, floating on the surface. The oil, water, and spirit have an intense odour of assafœtida. The oil, which is at first pale green, but gradually becomes yellowish-brown, has so powerful an odour that a single drop will taint the air of a large apartment; and if dropped upon the clothes, the fetor adheres to them for many days. It contains from 15·75 to 23 per cent of sulphur according to the temperature used in rectifying it [Stenhouse]. One portion seems a definite compound of sulphur with allyle, the compound organic radicle of oil of garlic [Tilley and Maclagan]. When spirit of ammonia, or a mixture

of salts capable of producing it, is distilled from assafœtida, the volatile oil and the ammonia pass over with the spirit, and form a fetid ammoniacal liquid, at first nearly colourless, but gradually becoming brownish; which is the *Spiritus ammoniæ fœtidus* of the Pharmacopœias. Assafœtida readily unites with other resins, gum-resins, and wax; and in this way various plasters may be formed, as in the case of the Edinburgh *Emplastrum assafœtidæ*. The composition of assafœtida has been examined both by Pelletier and by Brandes, whose results correspond on the whole. According to the analysis of the latter, it contains 47·2 per cent of resin soluble in ether, 1·6 of resin insoluble in ether, 19·4 soluble gum or arabin, 6·4 insoluble gum or bassorin, 4·6 volatile oil, with 10·5 of various salts, and also some water, sand, and other impurities.

Adulterations.—This drug is liable to various adulterations. The lump variety always contains a little sand owing to the mode of collecting it; but sometimes more is intentionally added. It is also at times mixed with common resin, or turpentine, or other resinous substances. Those sorts ought to be rejected which are very soft, which contain few tears, which present a brown agglutinating medium, abundant, soft, and not rendered rose-coloured by exposure, which exhale a pitchy odour in burning, or in which sand, stones and other mechanical admixtures visibly abound. The characters of the finer qualities have been described above.

Actions and Uses.—Assafœtida is a stimulant, both general and topical; and most of the other medicinal properties assigned to it may be referred to this action. It produces topical afflux of blood and some heat where it is applied. When swallowed, it excites the circulation and also the nervous system, increases the action of the cutaneous capillaries, sometimes augments the flow of urine, and tends to promote the menstrual discharge. As a stimulant, it is diffusible and transient; and hence it is a powerful antispasmodic. In common with other substances which contain highly odoriferous volatile oils, it is anthelmintic. In the course of its action as an internal remedy it undergoes absorption, and pervades almost every secretion of the body, such as the breath, perspiration, urine, saliva, and even, it is said, the pus secreted on external ulcers. Its effect on the bowels is uncertain, small doses appearing to constipate them, and large doses on the contrary tending to open them. Its active ingredient is in all probability its essential oil; at least there cannot be any other constituent in one of its most energetic preparations, the ammoniated spirit.

Its special uses continue to be numerous, but at one time were much more so. It is used to a great extent as a condiment in Persia and some adjacent countries; in which respect it seems equivalent to the garlic of some European nations. As a diffusible stimulant, it is a good deal used in the spasmodic nervous diseases of females, especially the various forms of hysteria. It is also an excellent antispasmodic in chorea, above all if united with resinous

cathartics or aloes; and some attach much value to it in the chronic, spasmodic stage of hooping-cough. As a stimulant it has been likewise employed in the typhoid forms of continued fever. Its diaphoretic action, which has led to its being employed in cutaneous diseases, cannot be greatly depended on; neither is its diüretic action certain or considerable; and its influence on the biliary secretion, admitted by some, is likewise not well marked. It is undoubtedly sometimes of service in amenorrhœa, and still more in dysmenorrhœa. As a vermifuge, it has often proved effectual in lumbricus and ascarides. Like other diffusible stimulants, it is a good carminative, and often removes flatulence, both when given by the mouth and administered in the way of injection. Few carminative injections are equal to the *Enema fœtidum.* By some physicians it has been considered a useful inspissant and expectorant in catarrh; but in this respect ammoniac, among the fetid gum-resins, has enjoyed most reputation. Lastly, by its disgusting taste and overpowering odour it is of service in the treatment of pretended diseases among soldiers and in civil hospitals. Sometimes however patients with real ailments are driven out of hospital by this device.——The best antispasmodic preparations of assafœtida are the ammoniated spirit, the tincture, and the simple pill, or compound galbanum pill; the most effectual as a carminative, and also in chorea, is the aloes and assafœtida pill of the Edinburgh Pharmacopœia; as an anthelmintic and emmenagogue any of its preparations may be employed; and the emulsion in frequent doses is the best form for the treatment of feigned diseases.

The doses of its preparations are the following: *Assafœtida*, E. L. D. gr. x. ad gr. xx. repeatedly. *Pilulæ assafœtidæ*, E. gr. x. thrice a-day. *Pilulæ galbani compositæ*, L. D. gr. x. ad gr. xv. thrice a-day. *Pilulæ aloes et assafœtidæ*, E. gr. x. twice or thrice a-day. *Mistura assafœtidæ*, L. D. fl. unc. ss. ad fl. unc. i. *Tinctura assafœtidæ*, E. L. D. dr. i. and as an injection, dr. ii. ad dr. iii. *Spiritus ammoniæ fœtidus*, E. L. D. dr. i. *Enema fœtidum*, E. D. as an injection. *Emplastrum assafœtidæ*, E. externally.

ASTRAGALUS CRETICUS, *D.* See *Tragacantha.*

ATROPA BELLADONNA, *D.* See *Belladonna.*

AURANTII AQUA, *E.* *Distilled water of the flowers of Citrus vulgaris, Risso, Ann. du Mus.* xx.—*DC. and sometimes of Citrus Aurantium, Ibid.; Orange-flower-water.*

TESTS, *Edin.* Nearly colourless; unaffected by sulphuretted-hydrogen gas.

AURANTII CORTEX, *E. L.* AURANTII TUNICA EXTERIOR, *D.* *Rind of the fruit of Citrus vulgaris, Risso, Ann. du Mus.* xx.—*DC.*; *Bitter-orange rind.*

AURANTII FLORES, *L. D.* *Flowers of Citrus Aurantium, DC.* (*Lond.*); *Orange-flowers.*

AURANTII FOLIA, *D.* *Leaves of Citrus Aurantium.*

AURANTII OLEUM, *E. L.* *Volatile oil of the flowers of Citrus vulgaris, Risso, Ann. &c.,—and sometimes of Citrus Aurantium, Ibid.* (*Edin.*) *Distilled oil of the flowers of Citrus Aurantium, Risso* (*Lond.*) *Neroli-oil.*

AURANTII SUCCUS, *D.* *Juice of the fruit of Citrus Aurantium; Sweet-orange-juice.*

CONSERVA AURANTII, E. CONFECTIO AURANTII, L.

PROCESS, *Edin.* Grate off the outer rind of bitter oranges, and beat it into a pulp, adding gradually thrice its weight of white sugar.

PROCESS, *Lond.* Take of
Fresh orange-rind, grated, one pound;
Sugar, three pounds.
Beat the rind in a stone mortar with a wooden pestle; then beat it again with the sugar into a uniform mass.

INFUSUM AURANTII, E. INFUSUM AURANTII COMPOSITUM, L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Bitter-orange peel, dried, half an ounce;
Lemon-peel, fresh, two drachms;
Cloves, bruised, one drachm;
Boiling water, a pint (old-measure, D.)
Infuse for fifteen minutes and strain (through linen or calico, E.)

SYRUPUS AURANTII, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Fresh bitter-orange peel, two ounces and a-half (eight ounces, D.);
Boiling water, a pint (6 pints old-m. D.);
White sugar, 3 pounds (a sufficiency, D.)
Infuse the peel in the water for twelve hours in a covered vessel; pour off the liquor (and filter it if necessary, E.); add the sugar to the liquor (and dissolve it with the aid of heat, E.)

TINCTURA AURANTII, E. L.

PROCESS, *Edin. Lond.* Take of
Bitter-orange-peel, dried, 3½ ounces;
Proof-spirit, two pints.
Digest for seven (fourteen, L.) days; strain and express strongly; and filter the liquor.

This tincture may be made by percolation, by cutting the peel into small pieces, macerating it in a little of the spirit for twelve hours, and beating the mass into a coarse pulp before putting it into the percolator. (*Edin.*)

FOR. NAMES.—*Fren.* Orange.—*Ital.* Arancio; Melarancio.—*Span.* Naranjo.—*Port.* Laranja.—*Ger.* Pomeranze; Aepfelsine.—*Dut.* Oranjeappel.—*Swed.* Pomerans.—*Dan.* Pomerantze.—*Russ.* Pomerants.—*Arab.* Saku limba.—*Pers.* Naurunj.—*Tam.* Kichlie pullum; Collungie pullum.—*Hind.* Naranj.

Citrus aurantium figured in Risso, Ann. du Mus. xx. Tab. 1.—Hayne, xi. 28. Citrus vulgaris figured as Citrus aurantium, L. in Nees von E. 425.—Steph. and Ch. i. 14.

Natural and Chemical History.—THE ORANGE, at least, the bitter variety of it, was known in all probability to the ancients. The tree was probably brought into Spain by the Moors. It seems to have been introduced into Portugal in 1520; but was known to thrive in the south of France at least two centuries earlier (Geiger). It grows wild in various parts of northern Africa and eastern Asia; and is cultivated in almost every tropical country, as well as in the warmer parts of the temperate zones. The orange belongs to the

natural family *Aurantiaceæ* or *Hesperideæ*, and to Linnæus' class and order *Monadelphia Icosandria.* Linnæus admitted only one species of it under the name of *Citrus Aurantium;* but botanists now generally follow the arrangement of Risso, who has adopted two species, the *C. vulgaris*, which produces the Bitter or Seville orange, and the *C. Aurantium*, which comprises a great number of varieties, producing the different kinds of sweet orange, among which the Common orange, the China or mandarin orange, the Maltese orange, and the St Michael's orange are the best known in this country and the most remarkable. The trees which produce the sweet and the bitter orange closely resemble one another, —the chief differences being that the bitter-orange tree is less than the other; its leaf-stalks more distinctly winged; its flowers more purely white and of a sweeter fragrance; the rind of its fruit of a darker orange hue and more bitter; and its pulp bitter and less saccharine. Both species are officinal; and both yield several officinal articles.

The Leaves of the sweet orange, which have been admitted into the Dublin Pharmacopœia, are studded with vesicles containing an essential oil, and have a bitter aromatic taste; on account of which they are a good deal used abroad, though little in Britain, for making a bitter aromatic infusion, useful as a vehicle for covering the taste of nauseous drugs. The Flowers of the bitter orange have a peculiar powerful fragrance, which is delicious in an orange grove, but rather luscious and oppressive in a room or conservatory. Those of the sweet-orange tree possess a similar fragrance, but are considered not so delicate in this respect. Both lose their aroma in a great measure by drying, and altogether when long kept; but it may be preserved for a long time either by beating the flowers into a pulp with a fourth of their weight of common salt, or by parboiling them and corking them closely in bottles according to the method of Appert. The flowers owe their fragrance to a peculiar essential oil, which may be got either in the state of pure oil, or in that of distilled water, by distilling water from the fresh flowers or from those which have been preserved with salt. The best Orange-flower-water is obtained from the flowers of *C. vulgaris*, the bitter orange. It is prepared in Italy, the south of France, and at Paris; and the Parisian water is most esteemed in France, because the excess of essential oil distilled over is not removed. It has little colour or a pale straw-yellow tint, a rich fragrance of the flower, and a bitterish aromatic taste. It keeps well unless tainted by some of the fluid in the still having been accidentally driven over. What is used in this country is entirely imported from abroad, and commonly in large copper bottles. I have sometimes found it full of scales of carbonate of lead, owing to the action of the distilled water on lead, used instead of ordinary solder for uniting the sheets of copper. The Edinburgh Pharmacopœia

has provided for this adulteration by directing sulphuretted-hydrogen to be used as a test. Impurity from the contents of the still being spurted over is detected by the water being coloured though recent, and by its becoming soon offensive and even mouldy. The ESSENTIAL-OIL, commonly called Neroli-oil, is obtained in the proportion of an ounce from 550 pounds of flowers; and both species are used for the purpose, though the finest oil is got from the flowers of the bitter orange. In France that which is obtained near Paris is esteemed finer than that prepared in the south (Raybaud). It has a deep orange-red colour, and an intense odour of orange-flowers. On account of its high price it is seldom to be obtained pure in this country. It is introduced into the London and Edinburgh Pharmacopœias as a convenient article for making orange-flower-water extemporaneously by agitation with distilled water and filtration. It is much esteemed in perfumery. The FRUIT of the sweet orange has been admitted into the Materia Medica on account of its pulp and juice; which consist chiefly of sugar, mucilage, and citric acid. It differs much in quality; and some kinds prevalently met with in the shops of this country are so coarse as to be unfit for medical use. The best have a smooth, thin dark rind; and the finest variety imported into Britain is the St Michael's orange. The fruit of the bitter orange again is introduced into all the British Pharmacopœias on account of its rind, the *Flavedo* of the older pharmaceutic authors, the *Aurantii cortex* of the present day. It is officinal both in the fresh and dried state. As the outer part is its only active portion, the inner white part should be removed as far as possible before desiccation. The fresh rind has a deep orange-colour, a powerful grateful aroma, quite different from that of the flowers, and a pleasant bitter taste. It consists essentially of a volatile oil contained in visible vesicles, a sweet principle, a bitter principle which has not yet been satisfactorily separated, and ligneous fibre. The volatile oil may be obtained by expression from the grated rind or by distilling it with water. In the former way is prepared the OIL of ORANGE of the shops, which must not be confounded with Neroli-oil, the produce of the orange-flower,—as many, including even Mérat, have done. The finest oil of orange is obtained from the rind of the sweet orange, and is imported by the perfumer from Portugal. It has a pale straw tint and a rich fragrance of the rind. It is not officinal, but it is much used in cookery and perfumery. An inferior sort obtained from the bitter-orange rind is often substituted for the other. The fresh bitter-orange rind beat up with sugar forms an excellent conserve, the *Conserva* or *Confectio aurantii* of the Pharmacopœias, a variety of the familiar confection called marmalade; and it makes an agreeable syrup which is likewise officinal. Both preparations are much used in extempore prescriptions for imparting the form of mixture or of electuary to some drugs, and for covering the taste of others. When the rind is dried it acquires a dark dirty reddish brown tint,

and loses much of its aroma in consequence of the escape of its volatile oil; but it retains its strong agreeable bitterness. It is used in this state for making the officinal *Infusum* and *Tinctura aurantii.* The fruit in the young state, when about the size of a pea, or a hazel-nut, is sold under the name of Orangettes or Curaçoa Oranges; and the small ones are sometimes used for making pea-issues.

Actions and Uses.—The properties of the orange in relation to the animal body differ according to its several parts. The leaves and fruit-rind are tonic by virtue of their bitterness. The pulp of the fruit is nutritive, refrigerant, and antiscorbutic. The distilled water and oil of the flowers are stomachic, calmative and antispasmodic. The principal use made of these articles in British practice is in extempore prescription, for covering the taste of disagreeable drugs and correcting their tendency to induce nausea. One of them, however, the distilled water of the flowers, is probably a more active remedy than is commonly thought in this country. In France it is held in estimation as a calmative and anodyne in the slighter forms of functional diseases of the nervous system; and I have known it to produce sleep in the milder forms of hysteria, when taken in the dose of one or two ounces. The antiscorbutic properties of the pulp are shared by all the fruits of the genus Citrus. They are usually thought to be most powerful in the lemon; yet the orange is undoubtedly also a valuable remedy of the kind.

The doses of the preparations of the orange are as follows: *Aqua aurantii*, E. fl. unc. i. ad fl. unc. ii. *Infusum aurantii*, E. L. D. the same. *Syrupus aurantii*, E. L. D. fl. dr. i. ad fl. dr. ii. *Conserva* vel *Confectio aurantii*, E. L. dr. i. ad unc. i. *Tinctura aurantii*, E. L. fl. dr. i. ad fl. dr. ii.

AVENA, *E. L. D. Seeds of Avena sativa* (*L. W. Spr.*)

FOR. NAMES.—*Fren.* Gruau.—*Ital.* Orzo.—*Span.* Avena.—*Port.* Avea.—*Swed.* Hafregryn.—*Ger.* Haferkerne.—*Dut.* Haver.—*Russ.* Oves obiknovennoi.
FIGURES of Avena sativa in Nees von E. 28.

Natural History.—SEVERAL species of AVENA are cultivated for food in different parts of the world, among which may be chiefly mentioned, *A. brevis, nuda, fatua, orientalis, strigosa,* and *sativa.* The native country of *A. sativa*, the species most generally cultivated in Britain, is unknown; but it appears now to grow wild in several localities throughout Europe. It is an annual plant, of the natural family *Graminaceæ*, and of the Linnæan class and order *Triandria Digynia.* The only officinal part of the plant is the ripe seed, or rather the preparation of it called Groats. When the seed is kiln-dried, stripped of its husk and delicate outer skin, and then coarsely ground, it constitutes the *Oatmeal* of Scotland, a common farinaceous article of food for labouring people, as well as for children of every station. The husk, with some adhering starch from the seed, is sold under the inconsistent name of *Seeds*,

and yields some nutritive matter by a particular process to be described presently. When the seed without being roasted is stripped of all its teguments, including its innermost, silky, fibrous covering, it constitutes *Groats;* and when this is ground into fine meal or flour it is called *Prepared Groats.* Much of the preparation called oatmeal, comprising all the best descriptions of it, differs little from coarsely ground groats, except in having been slightly roasted, because most of the inner silky tegument of the seed is removed before it is put through the grinding-mill.

Chemical History.—Oats consist chiefly of starch, mucilage, sugar, albumen, and lignin, without any gluten. According to the analysis of Vogel, they contain 66 per cent of meal and 34 per cent of husk; and the dry meal is composed of 59 per cent of starch, 10·75 of saccharo-mucilaginous extract, 4·3 of albumen, 2 of oleaginous matter, and 24 of ligneous fibre and moisture. These results differ considerably from what I have obtained in the instance of oatmeal, which yielded 72·8 per cent of starch, 5·8 of saccharo-mucilaginous extract of a feebly sweetish taste, 3·2 of albumen, 0·3 of oleo-resinous matter, 11·3 of lignin in the form of coarse bran, and 6·6 of moisture. Later researches indicate so much as 14 per cent of nitrogenous ingredients. Analysis shows that oatmeal as used in Scotland contains nearly five-sixths of real nutriment; and the proportion will be greater when the seeds are carefully freed of the husks and teguments before being ground. Boiling water makes with it or with groats a ropy mucilage by dissolving the starch, sugar, and gum. When this mucilage is made by boiling three ounces of groats in three pints of water down to half the volume, and then straining, the liquid is named *Gruel;* and it is much used both in domestic and regular practice as a light farinaceous article of food in chronic affections and convalescence from acute diseases. When the meal in the coarse state is boiled in much larger proportion to the water, it forms on cooling to about 130° a stiff gelatinous pulp, which constitutes the *Porridge* of this part of Britain. Another dietetic preparation is made from the husks, which are detached in the manufacture of meal before it is ground. These, which are known here by the name of Seeds, if infused in hot water and allowed to become sourish in this state, yield on expression a mucilaginous liquid, which, on being sufficiently concentrated, forms a firm jelly known by the name of *Sowins.*——Oatmeal is insoluble in alcohol, ether, and the oils; but alcohol and ether remove an oleo-resinous matter from it.

Actions and Uses.—Oats are among the most nutritive of the grains; and, notwithstanding the sneers of Dr Samuel Johnson, oatmeal continues to form a staple and favourite article of food in Britain, but more especially in Scotland. It has the credit of tending to keep the bowels open; and I have seen it apparently have this effect in several instances of habitual constipation, when taken

at breakfast in the form of porridge. In cases of dyspepsia associated with acidity of the stomach, it is on the contrary in general a noxious article of food; and some dyspeptics among the working classes recover entirely on abandoning it for a time. A curious, though now rare, consequence of its long habitual use as food is the formation of intestinal concretions composed of phosphate of lime, agglutinating animal matter, and the small stiff silky-like bristles which may be seen at one end of the inner tegument of the oat-seed. This affection must have been common in Scotland during last century, as Dr Monro Secundus, collected forty-one specimens, still in the anatomical museum of this University. But it is now far less frequent, probably in consequence of the oats being more thoroughly cleared of their investing membranes before being ground into meal. I have had occasion to examine one specimen only, which was removed from the rectum by Mr Liston in a case of recto-vesical fistula. The only medicinal form, correctly speaking, in which oats are employed in modern practice, is that of gruel, which is taken either simply salted, or seasoned with sugar, honey, or the pulp of fruits. It is on a par as a demulcent with the different kinds of Barley-decoction, and may be conveniently used for the same purposes (see *Hordeum*). In the form of porridge oatmeal answers well for making poultices.

AXUNGIA, *E.* ADEPS, *L.* ADEPS SUILLUS, *D.* *Fat of Sus Scrofa. Axunge. Hog's-lard.*

ADEPS SUILLUS PREPARATUS, D.

PROCESS, *Dub.* Cut fresh hog's-lard into fragments; melt it with a gentle heat, and express it through linen.
As lard is often preserved through means of salt, it must be boiled and well stirred with twice its weight of water, and separated after the whole has cooled.

FOR. NAMES.—*Fren.* Graisse de Porc.—*Ital.* Sugna.—*Span.* Manteca de puerco. —*Ger.* Schweinefett.—*Swed.* Swinister.—*Dan.* Svinefidt.—*Dut.* Spek.—*Tam.* Poonie colupoo.

HOG'S-LARD was used by the Greek physicians under the name of Στεαρ ὑειον, and by the Latins under that of *Adeps suillus* or *Axungia.*

Natural and Chemical History.—It may be obtained from all parts of the body of the pig; but that employed in medicine is the fat of the omentum, mesentery, and loins. It is contained, like other animal fats, in a cellular tissue, traversed by blood-vessels. From these it is separated and purified by kneading it with cold water, beating it in a mortar, keeping it fused over the vapour-bath till it is quite clear, filtering it through linen, allowing it to cool and concrete, scraping off the lowest portion which is impure, melting the remainder again over the vapour-bath, and finally pouring it into pots or bladders for preservation (Soubeiran). Salt is sometimes added to prevent it becoming rancid; but all such lard is unfit for medical use until it be freed of the salt by

the process of elutriation, as described in the Dublin Pharmacopœia.

Good Axunge ought to be white, somewhat translucent, granular in appearance, yet smooth to the touch, of a sweetish taste, and without odour. It cannot be kept long however without acquiring a slight rancid odour and taste; and this alteration is promoted by free exposure to the air. It fuses about 100°; at an elevated temperature it burns; and when heated in close vessels it undergoes a species of destructive distillation, by which margaric, oleic, acetic, and probably benzoïc acids are formed, together with other less important modifications of its constituent fatty principles. It is insoluble in water, sparingly soluble in alcohol, more so in ether and the volatile oils; and when fused it dissolves wax and resins, on which account it is extensively used for making ointments and liniments. It is converted into a soap when boiled with caustic alkaline solutions. It consists of three neutral fatty principles, called Stearin, Margarin, and Oleïn. Stearin is white, concrete, crystallizable, friable enough to admit of its being pulverized, fusible at 144°, soluble in boiling alcohol or ether, very little soluble in either of these fluids when cold, and entirely convertible by the process of saponification (see *Sapo*) into a peculiar fatty acid, named Stearic acid, and a peculiar principle, soluble in water, and termed on account of its sweet taste Glycerin. Margarin is in most of its properties nearly identical with Stearin; but it is more fusible,—one variety, obtained from animal fats, melting at 116°, and another, from vegetable oils, at 82°. Oleïn is a colourless oily fluid, which becomes concrete at 20° F. It is more soluble in alcohol than the two other principles, soluble to any extent in ether, and convertible by saponification into glycerin, margaric acid, and oleïc acid. Axunge consists of 62 per cent of oleïn and 38 per cent of stearin and margarin together. Its proximate principles all consist of carbon, hydrogen, and oxygen.

Adulterations.—Axunge is sometimes adulterated with salt, which is added to make it keep better; and sometimes it is mixed with air in fine globules by whipping it as it cools, for the purpose of improving its colour. The former impurity is easily detected by the saline taste of the axunge, and the latter by minute ocular inspection. Rancidity, occasioned either by age, or by too strong a heat having been used in expelling water from it in the process of purification, may be discovered by the odour.

Actions and Uses.—Axunge is nutritive and emollient in its action on the body. It is more digestible than most other fats, and sometimes agrees even with dyspeptics. It is never used now as an internal emollient. But, on account of its cheapness, smoothness, and freedom from unpleasant odour, it is much employed for making officinal liniments, ointments, and cerates, and is more resorted to than any other fatty matter in extempore prescriptions for preparations of the like kind. It is also sometimes used alone for

frictions, and likewise as a simple dressing for healthy ulcers and blistered or excoriated surfaces. When it is applied to the latter purpose, care must be taken that it be not rancid. Dr Pereira observes that he has seen blistered surfaces ulcerate from neglect of this precaution, and I have repeatedly made the same observation.

BALSAMUM CANADENSE. See *Terebinthina.*

BALSAMUM PERUVIANUM, *E. L. D. Fluid balsamic exudation of Myrospermum Peruiferum, DC. (Edin.)—of Myroxylon Peruiferum, L. fil.—W. (Lond. Dub.)—Peru Balsam.*

BALSAMUM TOLUTANUM, *E. L. D. Concrete balsamic exudation of Myrospermum Toluiferum, DC. Spr. (Edin.)—of Myroxylon Peruiferum, L. fil.—W. (Lond. Dub.) Tolu Balsam.*

SYRUPUS TOLUTANUS, E. L. D.

PROCESS, *Edin. Dub.* Take of
Tincture of tolu, an ounce;
Simple syrup, two (1½, D.) pounds.
When the syrup has been recently made and has not altogether cooled, add the tincture by degrees agitating briskly.

PROCESS, *Lond.* Take of
Tolu balsam, ten drachms;
Boiling water, one pint;
Sugar, two pounds and a-half.
Boil the balsam in the water for half an hour in a loosely covered vessel, shaking it occasionally. Filter the liquor when cold; add and dissolve the sugar.

TINCTURA TOLUTANA, E. TINCTURA BALSAMI TOLUTANI, L. D.

PROCESS, *Edin. Dub.* Take of
Tolu balsam, in coarse powder, three ounces and a-half (one ounce, D.);
Rectif. spirit, two pints (16 fluidoz. D.)
Digest the balsam in the spirit with a gentle heat (in a close vessel, D.) till it be dissolved, and filter.

PROCESS, *Lond.* Take of
Tolu balsam, two ounces;
Rectified spirit, two pints;
Macerate till the balsam is dissolved, and filter.

FOR. NAMES.—*Balsamum Peruvianum. Fren.* Baume de Pérou noir.—*Ital.* Balsamo del Peru.—*Span.* Balsamo negro.—*Port.* Balsamo Peruviano.—*Ger.* Schwarze Peruvianische balsam.—*Swed.* Swart Perubalsam.—*Dan.* Sort Peruviansk balsom.—*Russ.* Peruvianskoi balsam.—*Balsamum Tolutanum. Fren.* Baume de Tolu.—*Ital.* Balsamo del Tolu.—*Span.* Balsamo de Tolu; Balsamo blanco.—*Ger.* Tolu balsam.—*Swed.* Tolubalsam.

FIGURES of Myrospermum peruiferum as Myroxylon peruiferum in Nees von E. 321.—Steph. and Ch. ii. 102.—Of Myrospermum toluiferum as Myroxylon toluiferum in Nees von E. 322.

Natural History.—THE BALSAMS of PERU and TOLU were made known in Europe by Monardes in 1580. Little was known of their natural history till 1781, when Linnæus's son, from specimens communicated by Mutis, described, under the name of *Myroxylon peruiferum*, the tree which produces the Peruvian balsam. Since that time the subject has been investigated by several eminent botanical authorities; but it is still involved in some obscurity. The plant which furnishes the balsam of Peru has been ascertained to grow in low, sunny situations amidst the Peruvian forests on the banks of the Maranon. It is likewise believed to inhabit Mexico, and also Colombia in the neighbourhood of Bogota. It is a fine

tall tree, the *Myrospermum peruiferum* of Decandolle, *Myrospermum pedicillatum* of Lamarc, or *Myroxylon peruiferum* of Linnæus' son, of Willdenow, Lambert, Kunth, Richard, and of Nees von Esenbeck. It belongs to Linnæus' class and order *Decandria Monogynia*, to Decandolle's natural family *Leguminosæ*, and to the *Amyridaceæ* of Lindley. The plant which yields the balsam of Tolu has not hitherto been so well examined. It is known to grow on the elevated plains near Tolu, as well as near Carthagena in the Magdalena province of Colombia. Like the other species, it is a fine forest tree, which has been named by Decandolle the *Myrospermum toluiferum*, but is more generally known as the *Myroxylon toluifera* of Kunth, and of Richard. Its flowers and fruit have not yet been examined by European botanists.—According to the most generally received opinion, the two species of *Myrospermum* are one and the same, and the two balsams the produce of a single species, modified somewhat by climate and situation. Nees von Esenbeck however has recently called this conjecture into question, and has pointed out and figured [op. cit.] material differences between the leaves of the two plants,—the only part which it has hitherto been possible to compare.

Chemical History.—Three varieties of Peruvian balsam have been described. One is pale-yellowish, syrupy, highly fragrant, and of a bitterish, aromatic, somewhat acrid taste. This kind, now scarcely known in commerce, is called White Peruvian balsam, and is considered to exude spontaneously or after incisions. It is said to dry up into a reddish, pulverisable, resinoid substance, which constitutes the second variety, called Dry Peruvian balsam or sometimes Indian Opobalsamum, and seems scarcely to differ from balsam of Tolu. Trommsdorff found in it 88 per cent of resin, 12 of benzoic acid, and a trace of volatile oil. The only familiar commercial variety known by the name of Peru balsam at the present time is the third, which is opaque, dark reddish-brown, syrupy, of an agreeable balsamic odour, and of a bitterish, acrid, aromatic taste. It is said by Ruiz to be obtained by boiling the young twigs and bark in water; but by Martius and others is supposed to be separated by a process of distillation *per descensum* in the same way as tar. It has a density about 1155. It does not dry up under exposure to the air. A temperature somewhat above 300° expels a little water and volatile oil; but if boiled with water, the water carries only a very small quantity of the oil along with it. It is entirely soluble in all proportions in alcohol, and in about five parts of rectified spirit, but only partially in ether. Prolonged boiling with water removes from it a crystalline acid, but nothing else. Stolze states it to be composed of 23 per cent of resin, 6.5 benzoic acid, a little extract and moisture, and 69 of a yellowish-brown oleaginous matter, which seems intermediate between the fixed and the volatile oils, as it boils at 257°, yet does not distil over with water, and stains paper permanently; but according to the more

recent researches of Fremy, it contains cinnamic acid, not benzoic acid, and its oil is a peculiar substance, which he calls Cinnameine. It is probably not a pure proximate body.——Tolu balsam is known in one form only,—that of a pale yellowish-red resinous substance contained in cocoa-nut shells, firm, brittle, and pulverisable, of a fragrant, balsamic, vanilla odour, and a sweetish aromatic resinous taste. The mode of obtaining it is not very well known; but in all probability it is exuded from incisions in the tree in the form of a liquid balsam, and subsequently hardens from keeping and exposure to the air. It is commonly imported in little cocoa-nut shells. It appears not to differ from the concrete White Peruvian balsam. It is entirely soluble in alcohol, rectified spirit, ether, and the volatile oils. It yields very little volatile oil when distilled with water; and both the water and oil have a strong odour of the balsam. It contains cinnamic acid [Kopp] and benzoic [Deville], two varieties of resin, and yields only 8 parts of volatile oil in 4000. The oil contains a radical oil Tolene [$C^{10} H^{8}$], and probably also cinnameine; but its analysis requires revision.

Adulterations.—In this country Peru and Tolu Balsam are seldom adulterated. The former when genuine sinks in water, does not separate into two layers when shaken with that fluid, and yields little or no volatile oil (Geiger) when subjected to distillation along with it. The latter ought to be easily soluble in alcohol, and to emit an odour of cloves when dissolved in alkaline ley (Geiger).

Actions and Uses.—The action of these balsams is stimulant. They are held to possess a specific influence over the pulmonary mucous membrane, diminishing inflammation there, and promoting expectoration. Hence they have been long used both in regular and domestic practice for catarrh, asthma, and other affections of the lungs. The balsam of Peru was originally introduced into European medicine as a vulnerary; and both it and Tolu balsam are still held by unprofessional persons to be sovereign remedies for healing recent wounds and ulcerated surfaces. For some years past however they have fallen into comparative neglect both as external and internal remedies; and they are now chiefly used in extempore prescriptions for imparting an agreeable odour and taste to mixtures and emulsions. Nevertheless they certainly do appear sometimes useful in chronic cases of catarrh, diarrhœa, and gleet. The officinal forms in use in Britain are the syrup and tincture for internal administration. An ointment, made with two parts of Tolu, three of almond-oil, four of gum-arabic, and sixteen of rose-water, makes an excellent liniment for excoriated nipples.

The doses of its preparations are *Balsamum peruvianum*, E. L. D. m. x. ad m. xx. *Tinctura tolutana*, E. *Tinctura balsami tolutani*, L. D. m. xxx. ad dr. i. *Syrupus tolutanus*, E. L. D. dr. i. ad dr. ii. Tolu balsam also forms a part of the *Tinctura benzoini composita* of the three Pharmacopœias, and of the *Trochis-*

cus morphiæ, *Trochiscus morphiæ et ipecacuanhæ*, and *Trochiscus opii* of the Edinburgh College.

BARYTAE CARBONAS, *L. E. D.* *Carbonate of Baryta.*

TESTS. *Edin.* One hundred grains dissolved in an excess of nitric acid are not entirely precipitated with one hundred and twenty-four grains of sulphate of magnesia.

TESTS. *Lond.* Entirely soluble in diluted hydrochloric acid; and the solution is colourless and not precipitated by ammonia, or hydrosulphuric acid, or, after being supersaturated by sulphuric acid, with carbonate of soda.

FOR. NAMES.—*Fren.* Carbonate de baryte.—*Ital.* Carbonato di barite.—*Ger.* Kohlensaurer baryt.

Chemical History.—THIS substance, the Witherite of mineralogists, is introduced into the Pharmacopœias not as a medicinal agent, but only as the material for making salts of baryta. It is not a common mineral, but abounds in some localities, especially in Lancashire. It occurs in veins, commonly along with ores of lead or copper, and sometimes in conjunction with the sulphate of baryta. It is seldom found crystallized, but generally in grayish or pale yellowish-gray masses, of considerable weight, and a fibrous, somewhat radiated texture. Its density is 4.3 or a little higher. It is tasteless and quite insoluble in water; but it dissolves with effervescence in muriatic and nitric acids.

The tests enumerated by the London College are intended to meet its most frequent impurities, which are sulphate of baryta, lime, oxide of iron, copper, and lead. Sulphate of baryta is left undissolved by diluted muriatic acid. In this solution ammonia will indicate oxide of iron by detaching a flaky brownish-yellow precipitate; and sulphuretted-hydrogen will detect oxide of copper or oxide of lead by throwing down a black sulphuret of these metals. Lime is best discovered by removing the baryta with sulphuric acid, adding an excess of that acid to take up any sulphate of lime that may have been precipitated along with the sulphate of baryta, and then testing the filtered solution with solution of carbonate of soda, which will throw down a white carbonate of lime. Most of these adulterations or impurities may be avoided by selecting samples of witherite which are colourless and of a uniform fibrous texture. The formula of the Edinburgh College will ascertain whether the carbonate of baryta is free from its most common impurities, sulphate of baryta, sulphate of lime, and carbonate of lime. The sulphate of baryta is left undissolved by the nitric acid. The two carbonates are dissolved, and also some sulphate of lime, the acid of which however at the same moment throws down some of the baryta in the form of sulphate. Hence, if to the solution of a given weight of the mineral, sulphate of magnesia be added,—sufficient to throw down within a small percentage of the whole baryta, were the carbonate pure,—it follows that if it be impure, the baryta in solution will be defective; and hence the filtered acidulous fluid will not yield any farther precipitate, as it would otherwise do, on the addition of more sulphate of magnesia.

Actions.—Although insoluble in water, carbonate of baryta is a rather active poison; for it is soluble in the acid gastric juices. It has been for some time known in Lancashire to be a poison to the lower animals, and is used instead of arsenic for killing rats.

BARYTAE MURIAS, *E. D.* BARII CHLORIDUM, *L.*
Crystallized Chloride of barium. Hydrochlorate of Baryta.

TESTS, *Edin.* One hundred grains in solution are not entirely precipitated by 100 grains of sulphate of magnesia.

PROCESS, *Edin.* Take of
Carbonate of baryta in fragments, ten ounces;
Pure muriatic acid, half a pint;
Distilled water, two pints.
Mix the acid and water, add the carbonate by degrees; apply a gentle heat towards the close of the effervescence; and when the action is over, filter, concentrate, and set the solution aside to crystallize.

Or,—Take of,
Sulphate of baryta, one pound;
Charcoal in fine powder, two ounces;
Pure muriatic acid, a sufficiency.
Heat the sulphate to redness; pulverize it finely when cold, and mix it intimately with the charcoal; subject the mixture to a low white heat for three hours in a covered crucible; pulverize the product, put it gradually into five pints of boiling water, and boil for a few minutes; let it rest for a little over a vapour-bath; pour off the clear liquor, and filter it if necessary, keeping it hot. Pour three pints of boiling water over the residuum and proceed as before. Unite the two liquids, and while they are still hot, or, if cooled, after heating them again, add pure muriatic acid gradually so long as effervescence is occasioned. In this process the solutions ought to be as little exposed to the air as possible; and in the last step the disengaged gas should be discharged by a proper tube into a chimney or the ash-pit of a furnace. Strain the liquor, concentrate it, and set it aside to crystallize.

Lond. The same as Edinburgh First Process.

Dub. The same with Edinburgh Second Process, except that the sulphate and charcoal are used in the proportion of ten to one, and that the sulphate is thrown while hot into cold water and very finely pulverized by levigation, as directed for chalk.

SOLUTIO MURIATIS BARYTAE, E. BARYTAE MURIATIS AQUA, D. LIQUOR BARII CHLORIDI, L.

PROCESS, *Edin. Lond. Dub.* Take of
Muriate of baryta, one drachm (part, D.);
Distilled water, a fluidounce (three parts, D.)
Dissolve the salt in the water.

FOR. NAMES.—*Fren.* Chlorure de barium.—*Ital.* Cloruro di bario.—*Ger.* Chlorbarium.—*Russ.* Chloristoi bary.

Chemical History.—THIS is a salt of more importance now in pharmaceutic analysis than in medicine. It is always so pure that the London College has not considered any tests of its purity necessary. It is obtained in one of two ways, both of which are given by the Edinburgh College,—from the carbonate of baryta by single decomposition with muriatic acid, and from sulphate of baryta by first converting that compound into sulphuret of barium by charcoal and heat, and then converting the sulphuret by solution into hydrosulphate of baryta, and this again into hydrochlorate of baryta by single decomposition. In the conversion of the sulphate of baryta into sulphuret of barium, the charcoal aided by heat decomposes the sulphuric acid and oxide of barium, resolv-

ing them into sulphur and barium, and passing off in the form of carbonic oxide gas, which burns with a blue flame around the edge of the crucible-cover. The changes that ensue on dissolving and decomposing the sulphuret are easily understood on reflecting, that metallic sulphurets and metallic chlorides are considered to become hydrosulphates and hydrochlorates of oxides when they are dissolved in water. The success of the second process of the Edinburgh College, which is also that of the Dublin Pharmacopœia, depends, first, on the sulphate being finely powdered,—secondly, on its being very carefully mixed with the charcoal,—and thirdly, on at least a full-red heat being kept up. The Dublin College however is unnecessarily particular as to pulverizing the mineral; for I have found every atom of it reduced by the Edinburgh formula where simple trituration is practised. The heat of a good kitchen oven kept up for three hours is in this way sufficient for yielding a pure semifused sulphuret. The London College has not thought it necessary to introduce the process by reduction of the sulphate. But this is wrong; for in most parts of the country, as at Edinburgh, this mineral is much more easily obtained than the carbonate. Besides, the sulphate gives in general a purer salt.

The chloride of barium when crystallized assumes the form of rectangular tables bevelled on their edges, and often truncated on two, or all, of the angles. Its density is 2.82. It is colourless and transparent, permanent in the ordinary state of the atmosphere, but efflorescent if the air be very dry; and it possesses an intense, nauseous, bitter, saline taste. Heat causes decrepitation owing to the discharge of water, and at a higher temperature fuses the anhydrous salt. It is soluble according to Gay-Lussac, in somewhat less than twice and a half its weight of temperate water, and in little more than its own weight at the temperature of ebullition. It is sparingly soluble in rectified spirit, and insoluble in pure alcohol. Its solution in water gives with sulphuric acid and the soluble sulphates a heavy white precipitate of sulphate of baryta, insoluble in nitric acid. A concentrated solution when saturated by ammoniacal gas deposits caustic baryta in crystals [Muratori.] In common with other barytic salts, it is best distinguished from the corresponding salts of strontia by the latter imparting a red colour to the flame of rectified spirit. Muriate of baryta or chloride of barium is now commonly considered a compound of one equivalent of barium, one equivalent of chlorine and two equivalents of water ($Ba + Cl + 2\ HO$), and consequently of 68.7 metal, 35.42 chlorine, and 18 water. But it may equally well be viewed as a hydrochlorate of baryta with one equivalent of water ($BaO + HCl + HO$); and those who take this view of the constitution of the crystallized salt consider the salt fused at a red heat as the only true chloride of barium ($BaCl$).

Adulterations.—It is always pure as met with in the shops of this

country. The tests mentioned by the London College under the head of the carbonate of baryta will detect lime, copper, lead, or iron,—which are apt to be present as impurities chiefly when the salt has been prepared from the carbonate. When prepared from the sulphate, the extraneous metals are separated in the form of insoluble sulphurets. The formula given by the Edinburgh College for testing its purity is so devised, that on adding sulphate of magnesia in a fixed proportion to a solution of the barytic salt, a small percentage of the latter will remain dissolved, if it was pure; and this will be shown by adding more sulphate of magnesia to the filtered fluid. If the salt be impure no farther precipitation will then ensue.

Actions and Uses.—The chloride of barium is in large doses an irritant and narcotic, and in medicinal doses has been considered a deobstruent and tonic. It is a poison, producing sometimes inflammation of the alimentary canal, sometimes coma and convulsions. Its antidote is any soluble alkaline or earthy sulphate. Its physiological effects in small medicinal doses are not well known; but when the dose is somewhat increased, pain in the stomach, nausea and vomiting ensue. It has been considered by many a valuable tonic deobstruent, and was therefore administered in all forms of scrofula, in glandular enlargements and rickets. Its properties in these disorders have been much overrated, and are now in discredit. It is used by some as an anthelmintic, by others as a stimulant wash for opacities of the cornea. At the present moment it may be considered out of use in British practice. Some employ it in the form of ointment to strumous sores and scaly and impetiginous diseases of the skin.

Its only officinal form is the *Aqua muriatis barytæ*, E. D. min. v. ad min. xx. thrice a-day. *Liquor chloridi barii*, L. min. v. ad fl. dr. i.,—in which, for no apparent reason, the London College has diluted the pre-existing solutions of the Colleges with nearly two volumes of water.

BARYTAE NITRAS, *E.* *Nitrate of Baryta.*

PROCESS, *Edin.* This salt is to be prepared like the muriate of baryta, substituting pure nitric acid for the muriatic acid.

SOLUTIO BARYTAE NITRATIS, E. (Test.—*See Introduction.*)

FOR. NAMES.—*Fren.* Nitrate de baryte.—*Ital.* Nitrato di barite.—*Ger.* Salpetersaurer baryt.—*Russ.* Azotnokisloi barit.

NITRATE OF BARYTA is an indispensable pharmaceutic test, but is not used in medicine. The Edinburgh College has introduced both the salt, and a solution of a given strength, which is convenient for detecting certain adulterations of officinal salts and acids.

Chemial History.—It is obtained like the muriate. It readily crystallizes in octaedres of a somewhat adamantine lustre and

considerable weight. It has an acrid bitter taste. It is permanent in the air. Heat fuses it, and when raised, drives off the nitric acid in the form of oxygen, nitrous acid, and other compounds of oxygen and azote,—leaving pure baryta. It enlivens the combustion of burning fuel, like other nitrates. It is soluble in twelve parts of temperate water, and in three parts at 212°. The solution gives with sulphuric acid and the sulphates a precipitate insoluble in nitric acid; and when decomposed with sulphuric acid, it becomes yellow if heated with morphia, provided the solution be not too diluted.

BARYTAE SULPHAS, *E. D.* *Sulphate of baryta. Heavy-spar.*

For. Names.—*Fren.* Sulphate de baryte.—*Ital.* Solfato di barite; Spato pesante.—*Ger.* Schwefelsauren baryt; Schwerspath.—*Swed.* Tungspat.—*Dan.* Tungspat.

The Sulphate of Baryta, or Heavy-spar of mineralogists, is a more common natural production than the carbonate of the same earth. It occurs most generally in connexion with metalliferous minerals, and in this country particularly with ores of copper. It occurs in veins, sometimes of considerable size, usually massive, but occasionally crystallized. It is of foliaceous texture, sometimes white, frequently flesh-coloured, perfectly tasteless, and insoluble. Its density is about 4.4, but varies somewhat. Its primitive crystalline form is the right rhombic prism; but its most common form is tabular. Although it contains no water of crystallization, heat causes some decrepitation and breaks it down to a coarse powder; but it does not fuse at the highest furnace temperatures. It is insoluble not merely in water, but likewise in the acids; boiling sulphuric acid alone exerting any solvent action over it, and that not considerable. When heated with charcoal it becomes the sulphuret of barium, as mentioned under the article *Barytæ murias.* From this sulphuret the various soluble salts of baryta may be obtained on decomposing it in solution by means of their several acids. Sulphate of baryta is composed of an equivalent of each constituent ($BaO + SO^3$), that is 76.7 of base and 40.1 of acid.

It is used only in pharmacy for preparing other barytic salts, especially the muriate.

BELLADONNA, *E. L.* BELLADONNAE FOLIA, *D.* *Leaves of Atropa Belladonna, L. W. Spr. Deadly nightshade; Belladonna.*

BELLADONNAE RADIX, *D.* *Root of Atropa Belladonna, L. W. Spr.*

Extractum Belladonnae, E. L., Succus spissatus Belladonnae, D.

Process, *Edin.* Take of fresh Belladonna any convenient quantity; bruise it in a marble mortar into a uniform pulp; express the juice; moisten the

residuum with water, and express again. Unite the expressed liquids, filter them, and evaporate the filtered liquor in the vapour-bath to the consistence of firm extract, stirring constantly towards the close.

Process, *Lond. Dub.* To be prepared from (fresh leaves of D.) Belladonna in the same way as extract of monks-hood. See *Aconitum.*

EMPLASTRUM BELLADONNAE, L. E. D.

Process, *Lond. Edin.* Take of
Resin-plaster, three ounces;
Extract of belladonna, 1½ ounce.
Melt the plaster with a gentle heat (over the vapour-bath, L.), add the extract, and mix them.

Process, *Dub.* Take of
Extract of belladonna, an ounce;
Soap-plaster, two ounces.
Make them into a plaster.

For. Names.—*Fren.* Belladonne.—*Ital.* Bella donna.—*Span.* and *Port.* Bella dona.—*Ger.* Tollkirsche.—*Dut.* Besiedraagend doodkruit; Doodelyke naghtschade.—*Swed.* Wargbär.—*Dan.* Natskade.—*Russ.* Krasavitsa; Odurnik.—*Arab.* Inubas saleb.—*Pers.* Roobah turbuc.—*Hind.* Sug-unggor.

Figures of Atropa Belladonna in Nees von E. 191.—Hayne, i. 43.—Roque, 65. —Steph. and Ch. i. 1.—English Bot. 592.

Belladonna has been long known both as a medicine and as a poison. The exact period of its introduction into medicine is doubtful, owing to the frequency with which it was long confounded with allied plants; but it has been distinguished since the middle of the sixteenth century. Its name is supposed to have been derived from the circumstance that the ladies in Italy at one time used the distilled water as a cosmetic for the face (Mérat.)

Natural History.—The plant, which belongs to the natural family *Solanaceæ*, and to Linnæus's class and order *Pentandria Monogynia*, is familiarly known in this country by the name of Deadly-nightshade, Belladonna, or Dwale. It inhabits the neighbourhood of ruins and waste places. It has a perennial root, and an annual herbaceous stem, from three to six feet high, branchy, and leafy. It produces flowers in June and July, and ripens its fruit in September. The chief officinal part of the plant is the leaf; but the whole plant possesses the same properties, and the root, which has been admitted into the Dublin Pharmacopœia, is more energetic than the leaf. As belladonna is often confounded by the herbalist with other plants, and its fruit is a common and powerful poison, its characters ought to be well known to every medical man. The root is branched and spreading,—fibrous, but pulpy and juicy,—white internally when fresh, grayish when dry,—of a mawkish slightly bitter taste and faint peculiar odour. The stem is herbaceous, upright, round, somewhat hairy, and reddish. The leaves, which it is particularly important to distinguish accurately, are sometimes alternate, more commonly in pairs, in which case one leaf of each pair is for the most part less than the other. They are ovate and acuminated, between four and six inches long or even larger, thin and soft, entire on the edge, without any hairs except on the nerves behind, and supported on a short leaf-stalk; and when dry, they have a brownish-green or grayish-green colour, scarcely any odour, and a faint bitterish taste. The flowers are towards an inch in length, solitary, axillary, bell-shaped, greenish

towards the flower-stalk externally, dingy-purple towards the rim and internally. The fruit is a dark brownish-black, shining berry, resting on a widely extended calyx, roundish but flattened, of the appearance and size of a black-cherry, bilocular, and containing many kidney-shaped seeds in a mucilaginous, mawkish, rather sweet, but not agreeably-tasted pulp.

The leaves are usually collected for the druggist before the flowers blow or soon afterwards. They are preferred from wild specimens; but there is no good evidence that the virtues of the plant are diminished by culture,—an important consideration, as its wild localities are limited in extent, while it is readily propagated both from the seeds and from cuttings of the root. They are apt to be confounded with the leaves of the *Solanum nigrum* and *S. Dulcamara.* Not long ago, a druggist in this city made a large quantity of extract from the latter plant by mistake; and the herbalist who supplied him offered a hundred-weight of leaves to another druggist, who detected the error. The leaves of *S. dulcamara* are considerably smaller, are supported on a leaf-stalk often nearly half as long as themselves, and frequently present a pair of small pinnæ at a short distance from their base. Those of *S. nigrum* are also comparatively small, not acutely acuminated, and upon the edge coarsely serrated. The root should be taken up in spring, and from plants at least three years old.

Chemical History.—The leaves according to Brandes contain, besides 40 per cent of ligneous fibre and water, some gum, albumen, chlorophyll and starch, a little wax, various salts, two azotiferous extractive matters analogous to gum, which he called phyteumacol and pseudotoxin, and one and a-half per cent of malate of atropia, in which the active properties of the plant are concentrated. For some time others failed to obtain his results, on account of the great liability of atropia to undergo decomposition, but although the properties of the pure principle as now known differ somewhat from those mentioned by him in his paper, it would appear that he was really the first to detect the true atropia. It is got with the greatest certainty in this manner (Mein). Twenty-four parts of dried root in very fine powder are digested for several days twice successively in sixty parts of rectified spirit. The filtered tincture is repeatedly agitated with one part of slaked lime, filtered again, faintly acidulated with diluted sulphuric acid, filtered a third time, distilled down to one-half, diluted with six parts of water, and evaporated at a very gentle heat till deprived of its spirit. The watery residuum is then filtered, carefully evaporated to two or three parts only, cautiously treated when cold with concentrated solution of carbonate of potash till it begins to be muddy, filtered again after standing a few hours, and then decomposed with the alkaline solution added so long as the turbidity increases. The precipitate, which is impure atropia, is separated after twelve hours by stirring and filtration, then dried without being washed,

rubbed with a little water into a paste, pressed in blotting-paper, dried again and dissolved in five times its weight of alcohol. To the tincture are added six times its weight of water; and if muddiness be not occasioned the mixture is evaporated till it become turbid; after which tufts of crystals of a yellowish colour form when the liquid is left at rest for about four-and-twenty hours. These crystals may be rendered colourless by repeating the process described in the last sentence.

Atropia when pure is white, crystallizable, permanent in the air and without odour. A moderate heat fuses it, and a heat considerably above 212° volatilizes most of it unaltered in close vessels; but in the open air it swells up, chars, and takes fire. It is soluble in all proportions in alcohol, in fifteen parts of ether, and in seventy parts of boiling water; and it is much more soluble, even in cold water, while impure. All these solutions are said by Geiger to have a strong, very disagreeable, bitter taste; but according to Mein, the watery solution is almost tasteless. They have an alkaline reaction. Strong alkaline solutions decompose atropia with the aid of heat, and disengage ammonia. The acids neutralize it and form crystallizable salts, of which the sulphate and acetate are most easily obtained in the crystalline state. Alkalis precipitate atropia from solution of these salts. It is an active poison. It consists according to Liebig of 69.84 per cent of carbon, 8.14 hydrogen, 7.52 azote, and 14.50 oxygen; and these bodies probably unite in the proportion of 22 equivalents of carbon, 15 hydrogen, 1 azote, and 3 oxygen ($C^{22}\ H^{15}\ N\ O^{3}$). It constitutes but a small proportion of the plant, Mein having obtained only twenty grains from twelve ounces of the root; and the Messrs Smith of this city only sixteen grains from thirty-two pounds of the leaves; but various circumstances render it probable that much disappears in the process of preparing it.

Belladonna leaves readily yield their virtues both to water and to alcohol. The only preparation now in use in British practice is the watery extract of the juice, the *Extractum* or *Succus spissatus belladonnæ*. This is directed to be obtained by evaporating the expressed juice over the vapour-bath, care being taken to beat the leaves into a smooth pulp before subjecting them to the press, and then to add a little water to the residuum and express again, so as to save the whole juice. As the extract of the shops is frequently inert, it may be inferred that the process for preparing it is often incorrectly conducted. The conditions for success indeed are not yet accurately known. But, as usual in the case of narcotic extracts, an elevated or prolonged temperature is probably detrimental. The extract prepared in vacuo is certainly very active; the common extract of the shops is also not bad, if a vapour-bath heat alone be used and the process be stopped as soon as the due consistence is attained; and it can scarcely be doubted that an alcoholic extract prepared according

The Edinburgh College has given as characters of its purity "a cherry-red colour, when old, wine-yellow when recent,—a pure cinnamonic odour,—and the property of being converted into a nearly uniform crystalline mass by nitric acid. It must be observed however that the last character will not distinguish it from oil of cassia, which is similarly acted on by nitric acid. This action too, I suspect, diminishes with the age of the oil, although it be quite genuine. The nitric acid, which must be concentrated, is best added slowly drop by drop to the oil contained in a watch-glass.

Among the adulterations of oil of cinnamon has been mentioned the admixture of a volatile oil obtained from cinnamon-leaves. The leaves yield by distillation a considerable quantity of oil of a pale yellow hue at first, gradually passing to smoke-brown, and of a strong pungent taste like a mixture of cinnamon and cloves. From the strong peculiar aroma of a specimen presented to me some time ago by Mr Marshall, this oil could scarcely be used with success for adulterating oil of cinnamon.

CINNAMON-SUET is a hard variety of impure stearine obtained by bruising and boiling the ripe fruit, which is of the size and form of a sloe or small olive. The suetty matter separates on the surface of the water in the form of an oil, which concretes on cooling into a granular mass of a dirty grayish colour. This I have found, from specimens I owe to Mr Marshall, to consist of about 8 per cent of elaine and 92 of a mixture of stearine and margarine fusible only at 110° It has been occasionally employed in Ceylon for giving light, but is now seldom applied to any useful purpose.

I am also indebted to the kindness of Mr Marshall for a small specimen of CAMPHOR obtained by him from the root of the Ceylon cinnamon-tree. It presents, so far as I have examined it, the properties of officinal camphor from the *Camphora officinarum.* It is merely an article of scientific curiosity, because the tree is much too valuable on account of its bark to be destroyed for the sake of its root.

That the cinnamon-tree is one of the sources of the CASSIA-BARK of commerce rests hitherto upon the authority of Mr Marshall alone. His first statement made to this effect in 1817,—that the third Ceylon cinnamon, which was then not allowed to be exported to Europe as cinnamon, did actually reach it as cassia-bark,—has been recently abandoned for the surmise, that, as it was for a few years after 1814 sold to eastern merchants on their engaging not to transmit it to Europe, it was probably sent nevertheless, but under the name of cassia. This may possibly have been the case for a brief period; but reasons have been assigned under the article *Cassiæ cortex* for supposing, that for at least 25 years no Ceylon cinnamon has ever reached Britain as cassia; and it does not appear to me, that any proof has yet been adduced of inferior cinna-

mons having been imported under that designation from any other quarter.

Mr Marshall farther endeavoured to show that the cinnamon-tree might produce the CASSIA-BUD of commerce, and recommended that the buds of Ceylon growth should be exported to Europe. The flowers of cinnamon, which are grayish-green, have a disagreeable odour like bone-saw-dust. When the germen begins to develope itself, it is partly embraced by the pointed divisions of the calyx; in which state it distantly resembles the commercial cassia-bud. It has been shown however in the article *Cassiæ cortex* that the characters of the flower-bud of the cinnamon-tree are decidedly different; and specimens sent to my predecessor from Colombo are so inferior in aroma that they never could occupy the same place in commerce.

Actions and Uses.—Cinnamon is a simple warm stimulant, with slight astringency. It is consequently tonic, stomachic, carminative and cordial; but it has also the reputation of being emmenagogue, and of diminishing the secretion of milk. The oil possesses similar properties, and is besides acrid enough to be without doubt a poison in considerable doses. Cinnamon and its oil are chiefly used, as warm antispasmodic cordials, in cramp of the stomach and colic, and for arresting sickness and vomiting,—as carminatives in flatulence,—and as stimulant aromatics for improving the taste of other drugs and correcting their nauseating influence on the stomach. They are hence employed to a great extent both in extempore prescriptions and in making the galenical preparations of the Pharmacopœias. The form of Tincture and that of Aromatic powder are most generally serviceable for such purposes. They form a part of no fewer than nineteen pharmaceutic preparations of the British Colleges, namely of the *Aqua cinnamomi*, E. L. D. *Spiritus cinnamomi*, E. L. D. *Tinctura cinnamomi*, E. L. D. *Tinctura cinnamomi composita*, L. *Pulvis aromaticus*, E. L. D. *Electuarium aromaticum*, or *Confectio aromatica*, E. L. D. *Infusum catechu*, E. L. D. *Decoctum hæmatoxyli*, E. D. *Spiritus lavandulæ compositus*, E. L. D. *Spiritus ammoniæ aromaticus*, E. L. D. *Tinctura cardamomi composita*, E. L. D. *Tinctura catechu*. E. L. D. *Acidum sulphuricum aromaticum*, E. D. *Pulvis cinnamomi compositus*, L. *Pulvis cretæ compositus*, E. L. D. *Pulvis kino compositus*, L. D. *Electuarium catechu*, E. D. *Vinum opii*, E. L. D. *Emplastrum aromaticum*, D. Cinnamon has even been held to possess febrifuge properties, and in some countries is popularly used for checking intermittents and other simple fevers at their commencement. It is one of the best of all additions to cinchona bark for correcting nausea or vomiting, which that drug sometimes occasions. It need scarcely be added that cinnamon and its oil are among the most agreeable and safe of all hot spices, and are accordingly very much used in the arts of the cook and confectioner.

The preparations of which cinnamon or its oil constitute the most

important part, and their doses are—*Cinnamomum*, gr. v. ad gr. xx. *Aqua cinnamomi*, fl.unc. ss. ad fl.unc. ii. *Spiritus cinnamomi*, fl.dr. ss. ad fl.dr. i. *Tinctura cinnamomi*, fl.dr. i. ad fl.dr. ii. *Tinctura cinnamomi composita*, E. L. fl.dr. ss. ad dr. ii. *Pulvis aromaticus*, E. D. gr. v. ad gr. xv. *Pulvis cinnamomi compositus*, L. gr. v. ad gr. xx. *Confectio aromatica*, L. D. *Electuarium aromaticum*, E. gr. x. ad scr. ii.

CNICUS, *D.* *Leaves of Cnicus benedictus*, *Gärtner. Spr. DC. Blessed-Thistle.*

For. Names.—*Fren.* Chardon-bénit.—*Ital. Span.* and *Port.* Cardo santo.—*Ger.* Benedikten flockenblume.—*Swed.* Cardebenedikt.—*Dan.* Corbendikt.—*Russ.* Voltschets kudravoi.

Figures of Cnicus benedictus in Nees von E. 223.—as Centaurea benedicta in Hayne, vii. 34.

The *Centaurea benedicta* of Linnæus, or *Cnicus benedictus* of more recent botanists, is the Ακοgνα of Theophrastus. It is a native of the south of Europe and of western Asia. It belongs to the Linnæan class and order *Syngenesia Polygamia æqualis*, and to the natural family *Compositae* of Decandolle or *Cynaraceæ* of Lindley. It is an annual herbaceous plant. The leaves, its officinal part, have a lasting bitter taste, which is readily imparted to water or to spirit. They contain a neutral, crystalline, very bitter principle (Nativelle).——The decoction, which has a nauseous taste, was once employed, like decoction of chamomile, to promote the operation of emetics; the infusion is diaphoretic; and this preparation, or a tincture, is sometimes used in small doses as a bitter tonic and stomachic. The crystalline principle causes vomiting in the dose of six grains. In small doses it has proved serviceable in ague. Notwithstanding its name, this plant is now so little used, that both the London and Edinburgh Colleges have omitted it in the last editions of their respective pharmacopœias.

COCCI, *E. L. D.* *Coccus Cacti: the entire insect.* *Cochineal.*

For. Names.—*Fren.* Cochenille.—*Ital.* Cocciniglia.—*Span.* Cochinilla.—*Port.* Cochenilha.—*Ger.* Cochenille; Nopal-schildlaus.—*Swed.* Consionell.—*Dan.* Cuzzinel; Carmosinorm.—*Tam.* Cochineel poochie.

The Cochineal-insect, and its utility as a dye-stuff, were made known to the Spaniards soon after their conquest of Mexico.

Natural History.—It belongs to the class of *Insecta* and the order *Hemiptera.* It is a native of Mexico, where it feeds on various species of *Cactus* and the allied genera, but especially the *Opuntia cochenillifera*, on which it thrives best. The insects are collected for commerce at different seasons. The product of the first collection, which consists of impregnated females, is the best; for at a later period, young insects and skins, both of which contain proportionally little colouring matter, are intermingled largely

with the former. In order to obtain good cochineal, the insects must be killed by heating them in a stove; for boiling water, used by some collectors, injures their quality. They are imported into this country from Vera-Cruz and Honduras (Pereira).

In this state the insect forms a roundish plano-convex body, rough and somewhat ringed on the back, weighing about a tenth of a grain, and scarcely two lines in length. Two sorts are met with in commerce, called Silver and Black cochineal. Silver cochineal, the most esteemed, is said to consist of the female insect killed before it has laid its eggs. It has a grayish-red colour, and the furrows of the rings are filled with a white bloom, which may be seen with a microscope to consist of fine down. Black cochineal, which is supposed to be the female after it has laid its eggs, has a dark reddish-brown colour, and is destitute of bloom. An inferior sort, called Granilla, consists chiefly of young insects. The siftings of all the sorts, mingled with impurities, are sometimes sold under the name of Garblings. Both the black and silver cochineal have a musty bitterish taste. The powder approaches in colour to carmine.

Chemical History.—It consists of various fatty matters, numerous salts, and a peculiar colouring matter, called by its discoverer, Pelletier, Carmin, but now more conveniently Cochenillin. This is the source of the utility of the insect as a dye-stuff. It is obtained by first removing the fatty matters with ether, and then dissolving out the cochenillin with boiling rectified spirit. It is granular, crimson, fusible about 112°, soluble both in water and alcohol, and capable of changing to violet when acted on by alkalis. It is the basis of the pigment called carmine. The colouring matter of the cochineal-insect is dissolved out both by water, alcohol, and proof-spirit. Its solubility in the last menstruum renders it available for imparting a fine colour to tinctures.

Adulterations.—Cochineal can scarcely be adulterated by any substitutions for the true insect, as its characters are very peculiar and easily appreciated. But the inferior black variety is sometimes sold for silver-cochineal by shaking it with powdered talc or heavy spar, by which means the furrows are filled with white powder, and the weight of the insect is considerably increased. This fraud is easily detected by the evident absence of downiness before the microscope. Some maintain that it is an error to undervalue black-cochineal, and that this variety yields most cochenillin (Guibourt). Exhausted cochineal is also sometimes sold for the superior kinds. The most convenient test of good cochineal is to infuse eight grains for an hour over the vapour-bath in 36 fluidounces of water containing ten drops of concentrated solution of alum, and to compare this with a standard solution in glass tubes, by diluting the deeper of the two till both have the same depth of colour.

Uses.—Cochineal is employed in medicine only as a colouring matter for giving a pleasant tint to other preparations, such as the

Tinctura cardamomi composita, the *Tinctura cinchonæ composita*, the *Tinctura serpentariæ*, E. *Tinctura gentianæ composita*, E. and *Tinctura hellebori*, E.* It is said to be diuretic and calmative, and some have used it on the latter account in hooping-cough as well as neuralgia.

COCCULUS, *E.* COCCULI SUBEROSI FRUCTUS, *D.*

Fruit of Anamirta Cocculus, Wight and Arnott, Flora Penins. Ind. Orient. (Edin.) *Berries of Cocculus Suberosus*, DC. (Dub.) *Cocculus Indicus.*

Tests, *Edin.* The kernels should fill at least two-thirds of the fruit.

Unguentum Cocculi, E.

Process, *Edin.* Take any convenient quantity of Cocculus Indicus, separate and preserve the kernels, beat them well in a mortar, first alone, and then with a little axunge; and then add axunge till it amounts altogether to five times the weight of the kernels.

For. Names.—*Fren.* Coque du Levant.—*Ger.* Kokkelskörner; Fischkörner.—*Swed.* Kokkelkorn.—*Tam.* Kakacollie veiei.

Figures of the fruit of Anamirta Cocculus in Gärtner's Fruct. 70. i. as Menispermum Cocculus. The plant under the same name in Roque, 145; but this seems the figure of a different species.

Cocculus Indicus has been known as a medicine and used as a poison for fishes since the time of the Arabian physicians, by whom it is described under the name of *Maheradsch* (Wallich).

Natural History.—For many centuries it was known in European commerce only as coming from the Levant; but its plant does not grow nearer than the Malabar coast, and the eastern islands of India. This is the *Menispermum Cocculus* of Linnæus, afterwards separated with some allied species by Decandolle into a new genus, and called *Cocculus suberosus*, and now again detached by Messrs Wight and Arnott into a newer genus and termed *Anamirta Cocculus.* This species belongs to the Linnæan class and order *Monœcia Dodecandria*, but to the *Hexandria Trigynia* in the sexual arrangement, as altered by Willdenow. It is one of the Natural family *Menispermaceæ* of Decandolle and of Lindley. The most recent account of it is that of Drs Wight and Arnott, who describe it as a strong climber with a very corky bark, roundish or cordate leathery leaves, racemose female flowers, and roundish unilocular fruit, somewhat larger than the largest pea, and with the structure of a drupa. The officinal part is the dried fruit, which is now all imported from India directly; so that its old continental name, Coque du Levant or Levant-shell, is misapplied in the present day. It has been supposed that the drug of European commerce is obtained from other species besides the *A. Cocculus*, such as the *Cocculus lacunosus*, and *C. Plukenetii* of Decandolle. The *C. suberosus* or *A. Cocculus* however has been clearly ascertained by Roxburgh to furnish at all events the chief part of it.

Chemical History.—Cocculus Indicus is a dry light roundish

fruit about the size of a large pea, consisting of the pulp of the drupa shrivelled to a firmly-adhering dark-brown skin, a thin ligneous pericarp within this, and a single seed in the form of a roundish kernel, somewhat kidney-shaped in consequence of being much excavated at the hilum. The fruit seems to be often plucked before it is ripe; for the kernel seldom fills the shell, and is frequently little else than a shrivelled membrane. The kernel is fatty, and possesses scarcely any odour, but a most intense, disagreeable, bitter taste. The shell, or rather the exterior shrivelled pulp, has a feebly bitter taste. The kernel imparts its properties better to rectified spirit than to any other solvent. It consists of 50 per cent of a concrete oil, Stearophanic acid, 2 per cent of a peculiar crystalline principle named Picrotoxin, some albumen, colouring matter, and various salts, besides ligneous fibre (Boullay). The shell contains two alkaloids in minute quantity, termed by their discoverers Menispermina and Paramenispermina (Pelletier and Couerbe). Picrotoxin is the active principle of the drug. It may be obtained in a variety of ways, of which the following has appeared to me the most convenient. The kernels, thoroughly freed of the shells, are to be beaten to a pulp in a mortar heated to 212°; the concrete oil is then expressed between heated plates; the residuum reduced to powder, is exhausted by percolation with rectified spirit, and the spirit distilled off as far as possible in the vapour-bath. The residue, which is intensely bitter, is then agitated with boiling water faintly acidulated with muriatic acid; upon which some concrete oil separates and floats on the top, while the picrotoxin is dissolved, and may be obtained on cooling the water after moderate concentration. By dissolving the dark crystals thus formed in boiling acidulated water, and treating the solution with animal charcoal, pure crystals will be formed on cooling. Picrotoxin is in colourless shining tabular crystals when pure, and may be obtained in rhombic prisms. It is intensely bitter. It is soluble in two parts of pure ether, three parts of alcohol, and about twenty-five parts of boiling water. The aqueous solution deposits most of it on cooling, and if acidulated, finer crystals are thus obtained than in any other way. It was conceived by its discoverer Boullay to be an alkaloid, but has been since proved to be neutral, or rather to possess in an imperfect manner the relations of an acid. Its constitution appears to be $C^{12} H^{7} O^{5}$ (Pelletier and Couerbe). It contains no azote as asserted by Liebig.

Actions and Uses.—Cocculus Indicus was probably first known in Europe as a poison for taking fish; which it first throws into violent irregular motion, and then stupefies. It was also used from an early period by unprincipled brewers, partly for giving beer a due degree of bitterness without the employment of hops, partly to make it more intoxicating; and the practice, though prohibited by severe statutes in this and other countries, is still secretly followed. It is an active poison, adequate to occasion death, and

producing chiefly giddiness, staggering, tetanic convulsions and coma. Fish killed with it are said to produce the same poisonous effects with the drug itself (Goupil); but this is a mistake, as is well known to the inhabitants of the Indian Islands, and also to boys in this country. Nothing is known of its actions in small doses, because little use has been made of it in modern times as a medicine. But when applied externally in the form of fine powder, it is an approved remedy in the East for the destruction of vermin on the skin, as well as for the cure of scabies; and in the form of ointment it is one of the best applications for the treatment of ring-worm of the scalp. The late Dr Hamilton, Senior, of this city, used it with success in that often untractable affection, and I have several times followed his method with great advantage. The ointment should be made, as the Edinburgh College directs, with the kernels only, and not with the shell too, as is often practised. It should be applied night and morning, and washed away with soap and water at least once a-day. From fourteen days to six weeks of treatment will be necessary in severe cases. I have occasionally seen it fail to cure the disease; but it always relieves the accompanying irritation of the skin. An ointment of Picrotoxin would probably be an effectual and convenient substitute for that of the crude drug; for it has been found of service in bad cases of the allied cutaneous disease Porrigo, when used in the proportion of ten grains of picrotoxin to an ounce of axunge. The actions of Cocculus Indicus in medicinal doses as an internal agent seem to merit investigation.

COCHLEARIA ARMORACIA, *D.* See *Armoracia.*

COCHLEARIA OFFICINALIS, *D.* *Herb of Cochlearia officinalis, L. W. DC. Spr.—Scurvy-grass.*

For. Names.—*Fren.* Cochlearia. *Ital.* Coclearia.—*Span.* Coclearia.—*Port.* Cochlearia.—*Ger.* Loffelkraut.—*Dut.* Lepelbladen.—*Swed.* Skedort.—*Dan.* Skeeurt.—*Russ.* Logetschnik.

Figures of Cochlearia officinalis in Nees von E. 399.—Hayne, v. 28.—Engl. Bot. 551.

At one time several species of *Cochlearia*, with other allied plants were in great request throughout Europe as antiscorbutic remedies, especially before the period when the improvements in agriculture put an end to the practice among the lower orders of living chiefly on salt provisions throughout the winter. Among these the *Cochlearia officinalis*, or common Scurvy-grass, occupied so prominent a place, that it is still retained in one Pharmacopœia of the British empire. It belongs to Decandolle's Natural family *Cruciferæ*, to the *Brassicaceæ* of Lindley, and to the Linnæan class and order *Tetradynamia Siliculosa.* It grows abundantly in this and other countries of northern Europe near the sea-coast. It is a succulent plant, which emits a pungent odour when bruised; and it has a

bitterish pungent taste, which is communicated to water and alcohol when distilled from it, but which is entirely lost by drying it. Its pungency is owing to a peculiar volatile oil; which, like that of several cruciform plants, is intensely pungent and diffusible.

There can be no question that it possesses antiscorbutic virtues. But it is now scarcely ever used either in regular or domestic practice.

COLCHICI CORMUS, *E. L.* COLCHICI AUTUMNALIS BULBUS, *D.* *Cormus of Colchicum autumnale, L. W. Spr.—Colchicum-bulb.*

COLCHICI SEMINA, *E. L.* COLCHICI AUTUMNALIS SEMINA, *D.* *Seeds of Colchicum autumnale, L. W. Spr.—Colchicum-seeds.*

Acetum Colchici, E. L. D.

Process, *Edin. Lond. Dub.* Take of
Fresh Colchicum-bulb, sliced, 1 ounce;
Distilled vinegar, sixteen fluidounces;
Proof spirit, one fluidounce.

Macerate the colchicum in the vinegar for three days in a covered glass vessel; strain and express strongly; filter the liquors and add the spirit.

Extractum Colchici Aceticum, E. L.

Process, *Edin. Lond.* Take of
Colchicum-bulb, a pound;
Pyroligneous acid, (Acetic acid, L.) three fluidounces.

Beat the Colchicum to a pulp, gradually adding the acid; express the liquid; and evaporate it in a porcelain vessel, not glazed with lead, over the vapour-bath to the due consistence.

Extractum Colchici Cormi, L.

Process, *Lond.* To be prepared from the colchicum-bulb, in the same way as Extract of Monkshood. See *Aconitum.*

Oxymel Colchici, D.

Process, *Dub.* Take of
Fresh Colchicum-bulb, sliced, 1 ounce;
Distilled vinegar, a pint;
Clarified honey, two pounds.

Macerate the Colchicum in the vinegar in a glass vessel for forty-eight hours; strain; express strongly, and add the honey. Boil the mixture, stirring it frequently with a wooden spatula till it attain the thickness of syrup.

Tinctura Colchici, E. L. Tinctura Seminum Colchici, D.

Process, *Edin.* Take of
Colchicum-seeds, ground finely in a coffee-mill, five ounces;
Proof-spirit, two pints.

This tincture is to be prepared like the tincture of cinchona; and percolation is much more convenient and speedy than digestion.

Process, *Lond. Dub.* Take of
Colchicum-seeds, bruised, five ounces;
Proof-spirit, two pints.

Macerate fourteen days, and strain.

Tinctura Colchici Composita, L.

Process, *Lond.* Take of
Colchicum-seeds, bruised, five ounces;
Aromatic Spirit of Ammonia, two pints.

Macerate for fourteen days, and strain.

Vinum Colchici, E. L.

Process, *Edin. Lond.* Take of
Colchicum, sliced and dried, 8 ounces;
Sherry, two pints.

Digest for seven (fourteen, L.) days; express strongly the residuum, and filter the liquors.

For. Names.—*Fren.* Colchique; Tue-chien.—*Ital.* Colchico.—*Span.* and *Port.* Colchico.—*Ger.* Zeitlose; Wiesen-saffran.—*Dut.* Tydloosen.—*Swed.* Tidlöse.—*Dan.* Nogne Jomfrue.—*Russ.* Bezvremennik.

Figures of Colchicum autumnale in Nees von E. 49.—Hayne, v. 5.—Roque, 23.—Steph. and Ch. ii. 70.—Eng. Bot. 13.

Colchicum was known to the Greek physicians as a poison under the name of Κολχικον, but was very little employed in medicine till so lately as 1763, when it was recommended, at the same time with monkshood and other powerful vegetable drugs, by Baron Störck of Vienna. Dioscorides describes it accurately, but as a poison only.

Natural History.—The plant belongs to the Linnæan class and order *Hexandria Trigynia*, to Decandolle's *Colchicaceæ*, and to Lindley's *Melanthaceæ*, in the Natural arrangement. It is the *Colchicum autumnale* of Linnæus and succeeding botanists, the Meadow-Saffron or Autumn crocus of vernacular speech, a common inhabitant of rich pastures in the middle and south of England, and likewise a familiar autumnal ornament of every garden. It is herbaceous, and the herb is annual; but the duration of the root differs according to the mode of propagation of the plant. It propagates itself in no less than three ways,—from seed,—by the formation of a single mature bulb from a parent bulb,—and by the separation of several immature bulbs from the parent. Its progress and mode of propagation must be carefully attended to, in order to arrive at a correct understanding of the period in the vegetation of the plant at which its chief officinal part, the bulb or *cormus* ought to be taken up.

Let the bulb be supposed to be in a state of full perfection, which will presently be seen to occur in the course of June or early in July. Soon afterwards, sometimes even in the end of June, a new bulb about the size of a grain of wheat, will be found at the lower end of the old one close to its junction with the radicles or root proper. This little bulb increases rapidly and at the same time begins to send up a flowering-stem without leaves. At length, towards the close of autumn, a long, naked, lilac or purplish, crocus-like flower springs from the ground, still without any leaves. The germen at this time remains at the bottom of the long tube of the corolla, under ground; and it continues there till the month of January or February, when at length the leaves for the first time show themselves above ground, and rising, like a bunch of tulip-leaves, elevate along with them the germen consisting of three many-seeded capsules, which ripen their seed about midsummer. After this the herb speedily dies and withers. While the flower is rising in the autumn the bulb forming its lower end is little larger than the diameter of the flower-stalk, of which it appears a mere dilatation. But it grows rapidly during the winter, in April it is as big as a chestnut, and in July it attains its greatest magnitude, being about the size of a small apricot. At this period in its growth, when it is a twelvemonth old, and the herb proceeding from it has ripened its seed and is withering,—a new bulb begins to appear near its lower end, close to the root proper: and this produces in

the autumn a flower and in spring a bunch of leaves, like its parent bulb before it. The parent bulb meanwhile, as the new flower rises, gradually becomes more spongy and watery; yet retains its size and form till next April, the second spring of its own existence. But after this, it quickly decays; so that by the end of May it consists of a shrivelled leathery substance, attached by a broad thin membranous band to the lower part of its progeny, now developed into a perfect bulb about the size of a chestnut. The bulb whose progress has thus been traced is therefore biennial, or, according to the views of some, triennial: It sees a part of three successive years; but outlives only two revolutions of each season.——The plant also propagates itself by the seeds; which ripen in the south of England. I am unacquainted with the progress observed by seedling plants.——In this part of the country, where the seed seldom comes to maturity, propagation takes place very differently, —namely by immature or infant bulbs being thrown off from the large bulb during the second or last spring of its existence. In January or February subsequent to the summer in which the plant ripens, or ought to ripen, its seed, and when the herb has for some months died off entirely, a little depression forms on the side of the bulb near the decayed remains of the leaves. Gradually a little oval corpuscle forms on this depression, while at the same time a little tongue-shaped membrane rises vertically behind it like an open lid. The corpuscle soon shoots out radicles at the lower end, and long slender leaves at the upper extremity which appear above ground in March or April; a small conical bulb is also formed where the radicles and leaves meet, but at the side of the junction, and about the size of a lemon-seed; and soon afterwards this immature bulb with its plant detaches itself from the parent, and may be found entangled among its radicles. Several such bulbs seem to be formed from one parent; and two may be occasionally seen at one time adhering to it, and in different stages of their progress. The production of these young plants is the last act in the functions of the parent bulb, which immediately afterwards becomes a dead shrivelled membrane. I have sometimes seen little plants beginning to form in this way so early as September. Their progress after separation is unknown; but probably several years elapse before they are far enough advanced to push out flowers.

The officinal parts of the Colchicum are the seeds and the bulb. The proper season for collecting the bulbs has been made the subject of question. On examining the plant attentively and bearing in view what has just been said of its history, it will be found that the bulb is whitest, firmest, and largest in the end of June and beginning of July. It then abounds in starch and is plump and firm; and when dried in slices, according to the usual practice, little, grayish, dense cakes are obtained, which have not undergone much shrivelling. At this time there is no other bulb connected with it except the shrivelled remains of the old one, and the first rudiment

of the new one. This is the period at which it is taken up by herbalists. If again it be dug up in April, two united bulbs will be found, one large, spongy, and watery, which contains very little starch,—another small, plump, firm, white, and more amylaceous. The former is the old bulb deprived of its starch by nourishing the leaves, and producing immature plants; the other is the young bulb, nine months old, which in the subsequent July attains its full size and plumpness. Some have thought the bulb should be collected at this particular period; but as its slices shrivel up into skiny shreds, the practice has been generally held to be erroneous. I suspect however that the doctrine of the majority may still be doubted. The plumpness and proportion of starch are certainly greater in July when the bulb is twelve months old, than in next April when it is obviously spongy and more watery; but in the latter state it has appeared to me quite as bitter, if not even more so, than when plump and full of starch; and its bitterness is obviously a more probable measure of its activity than any other criterion derived from its sensible qualities.——When the bulb is to be preserved for use, it is commonly stripped of its dark brownish-black tegument, cut into slices, and dried either spontaneously or at a temperature not exceeding 150°, but it may be dried entire and in fine condition, if the embryo bulbs be carefully removed [Houlton]. It is in good preservation if the slices are firm, dry, grayish-white, and capable of changing their colour to blue when softened with distilled vinegar, and then touched with tincture of guaiac. It has when fresh a strongly bitter, disagreeable, and somewhat acrid taste; which is preserved without diminution, if the drying process be properly managed.

Chemical History.—It imparts its bitterness to water and to alcohol, but still better to vinegar or diluted spirit of the strength of sherry. Hence distilled vinegar and sherry constitute the two most important officinal solvents for this drug; being used for preparing the *Acetum* and *Vinum colchici;* and the former is likewise used for preparing the *Oxymel* and *Extractum aceticum colchici.* The action of Colchicum on the body depends on a peculiar alkaloid, discovered by Geiger and Hesse, and termed *Colchicia*; which seems closely analogous to veratria (see *Veratrum.*) According to the analysis of Stolze the bulb in autumn contains 80 per cent of water, 10 per cent of starch, 2 of bitter extract, and 4 of sugar, with a little gum, lignin, and resin. In the month of March he found the starch diminished to 7.5 per cent, and the bitter extract increased to 6; which appears to confirm the doubts expressed above as to the propriety of collecting the bulb for medical use in the month of July.

Colchicum seeds are rough, roundish, dark brown, and about the size of millet-seed. They possess the same bitter acrid taste with the bulb, and in greater intensity. They have not been analyzed with care. They readily impart their bitterness and other sensible

qualities to proof-spirit; and hence their ordinary form for medical use is that of Tincture. As they are thought more uniform in strength, they are now generally preferred to the bulb.

Actions and Uses.—Colchicum in its action upon the animal body is an irritant, cathartic, emetic, and diuretic; it is also in the opinion of many a powerful sedative of the circulation; and in reference to gout and gouty rheumatism it has been commonly held a specific.

In large doses it is an energetic poison of the narcotico-acrid class. The irritant symptoms are severe vomiting and urgent diarrhœa, with a sense of dryness and burning in the throat, excessive colic and heat in the abdomen, great depression of the circulation, and sometimes suppression of urine. Frequently no other symptoms present themselves, and death takes place from exhaustion, the effect of inflammation of the bowels. But sometimes death is preceded by headache, delirium, stupor, and insensibility, denoting an action upon the nervous system. So small a dose as two drachms of the wine of colchicum has seemed sufficient in some constitutions to occasion fatal poisoning. The treatment of such cases consists in promoting evacuation upwards and downwards by diluents to expel the remains of the poison, and then uniting large opiates with counter-irritation of the abdomen or the application of leeches.

The actions of medicinal doses of colchicum have attracted much attention for some years past in this country. It seems to be a powerful sedative of the circulation in febrile inflammatory diseases; for which purpose it was first extensively employed by Mr Haden, and has been since strongly recommended by Dr Lewins. Its sedative influence on the circulation is also shown in cases of preternatural action of the heart, whether from functional or organic causes (Copeland). To this action too may probably be ascribed its well-known power of subduing the paroxysm of gout and checking the progress of subacute or gouty rheumatism,—a property however, which has been more generally referred to a specific action in those diseases. It is to its power of arresting gout, established by the late Sir Everard Home, that colchicum owes its extensive introduction into the practice of the present day. This power is undeniable; but the temporary benefit is represented by many to be obtained only at the risk of inducing irregular or atonic gout, or organic diseases. This opinion has not been substantiated. Many individuals have reached a good old age, though in the constant habit of checking their fits of gout by colchicum; and the relief obtained in most instances is so prompt and effectual, that a patient who has once experienced it will not easily be deterred from seeking it again by such remote and uncertain evils. The extension of the treatment from gout to gouty rheumatism led to its being finally applied to the cure of rheumatism in general. The cases where it is most serviceable are those of subacute and irregular rheumatism, where the disease flies from joint to joint, and

's attended with irregular, yet seldom high, fever. It is always most effectual when the rheumatic attack shows the greatest affinity to gout.——Farther, colchicum, as an active cathartic and diuretic, may be of service in dropsy. It was for this purpose that it was recommended by Störck, and it long kept possession of public favour. But for some time past it has gone out of fashion, having been displaced by other safer and equally effectual diuretics and cathartics. It increases greatly the secretion of urea, even when it does not increase the urine (Chelius, Lewins, Maclagan); and this effect has been particularly observed to attend its therapeutic action in cases of gout and other inflammatory diseases.

Colchicum cannot be safely used as a sedative in inflammatory diseases, or a specific in gout, without due caution and a thorough acquaintance with its properties. For on the one hand, it appears seldom to act therapeutically before producing a slight degree of that physiological action,—indicated by diarrhœa, colic pains, and frontal headache,—which in a higher degree constitutes it a poison; and on the other hand, this drug, owing either to individual differences in constitutional susceptibility, or to irregularities in the strength of its preparations, appears singularly variable in energy, so that what occasions no effect at all upon one individual excites alarming symptoms in another. The only allowable mode of administering it therefore is to begin with small doses and to repeat them with a frequency proportional to the urgency of the case, gradually increasing the dose till the disease begins to yield, or till colic and diarrhœa make their appearance. As soon as the bowels are affected, the action of the remedy must be diligently watched, and the doses at first suspended or diminished. By attending to these rules I have never had occasion to observe any unpleasant effects from the use of colchicum, or any symptoms which a dose of opium did not readily subdue. There are some, it may be observed, who doubt that the developement of the physiological action of this remedy is in any circumstance necessary for its therapeutic action. Its therapeutic is not always proportionate to its physiological action; but I am strongly inclined to believe that its good effects are not manifested until the constitution is so charged with it, that its physiological action straightway begins to show itself. I have never seen a case of rheumatism essentially benefited, till the patient began to suffer from colic and diarrhœa on the one hand, or from frontal headache and giddiness on the other. The ill success which some practitioners have encountered in using colchicum may have arisen from inattention to this circumstance. ——On account of the tendency of the remedy to debilitate the stomach, it is advantageously combined with aromatics, such as cinnamon-water, and with a little muriate of morphia.

The doses of its preparations are the following: *Colchici cormus*, E. L. *Colchici autumnalis bulbus*, D. gr. i. ad gr. v. ter indies vel sæpius. *Extractum colchici*, L. gr. ss. ad gr. ii. sæpe. *Extractum*

colchici aceticum, E. L. gr. ss. ad gr. ii. sæpe. *Acetum colchici*, E. L. D. fl.dr. ss. ad fl.dr. ii. sæpe. *Tinctura colchici*, E. L. *Tinctura seminum colchici*, D. m. x. ad fl.dr. i. ter indies vel sæpius. *Tinctura colchici composita*, L. m. x. ad fl.dr. i. ter indies. *Vinum colchici*, E. L. m. x. ad fl.dr. i. ter quaterve indies.

COLOMBA, *D.* See *Calumba*.

COLOCYNTHIS, *E. L. D.* *Pulp of the fruit of Cucumis Colocynthis, L. W. Spr. DC.* *Colocynth.*

EXTRACTUM COLOCYNTHIDIS, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Colocynth, a pound;
Water (distilled, L.) 2 gallons (1, D.)
Boil gently for six hours, replacing the water occasionally (down to four pints, D). Strain the liquor while hot; and evaporate it in the vapour-bath to the right consistence.

EXTRACTUM COLOCYNTHIDIS COMPOSITUM, L. D.

PROCESS, *Lond. Dub.* Take of
Colocynth sliced, six ounces;
Purified extract of aloes (Hepatic aloes, D.) in powder, twelve ounces;
Scammony powder, four ounces;
Cardamom powder, an ounce;
Soap, three ounces;
Proof-spirit, one gallon.
Macerate the colocynth in the spirit for four days with a gentle heat; strain the liquor; add the aloes, scammony, and soap; evaporate to the right consistence, adding the cardamom towards the close.

PILULAE COLOCYNTHIDIS, E. D.

PROCESS, *Edin.* Take of
Socotorine or Indian aloes, and
Scammony, of each, eight parts;
Colocynth, four parts;
Sulphate of potash, and
Oil of cloves, of each, one part;
Rectified spirit, a sufficiency.
Pulverise the aloes, scammony, and sulphate together; mix with them the colocynth, previously in fine powder; add the oil; and with the aid of a little rectified spirit, beat the whole into a proper pill-mass; which is to be divided into five-grain pills.

PROCESS, *Dub.* Take of
Colocynth, half an ounce;
Hepatic aloes, and
Scammony, of each, an ounce;
Castile soap, two drachms;
Sulphate of potash, and
Oil of cloves, of each, a drachm;
Molasses, a sufficiency.
Powder the aloes and scammony with the sulphate of potash; add the colocynth and oil of cloves; rub the whole into a mass with the soap and molasses.

PILULAE COLOCYNTHIDIS ET HYOSCYAMI, E.

PROCESS, *Edin.* Take of
Colocynth pill-mass, two parts;
Extract of hyoscyamus, one part.
Beat them well together, adding a few drops of rectified spirit if necessary; and divide the mass into five-grain pills.

FOR. NAMES.—*Fren.* Coloquinte.—*Ital.* Colloquintida.—*Span.* Coloquintida.—*Port.* Coloquintidas.—*Ger.* Coloquinte.—*Dut.* Koloquint.—*Swed.* Coloqwint.—*Dan.* Coloqvinder.—*Russ.* Colotsint.—*Arab.* Hunzil.—*Pers.* Hunzil.—*Tam.* Peycoomutikai; Varriecoomutikai.

FIGURES of Cucumis colocynthis in Nees von E. 268. Roque, 174. Steph. and Ch. iii. 138.

THIS drug has been used since the time of the Greek physicians, being well ascertained to have been the Κολοκυνθις of Dioscorides.

Natural History.—The plant is a creeper, belonging to the Linnæan class and order *Monœcia Syngenesia*, and to the Natural family *Cucurbitaceæ*. It is indigenous in various parts of western

Asia, the Greek archipelago, northern Africa, and the Cape of Good Hope. It produces a globular fruit of the size of an orange and nearly of the same colour, commonly called Coloquintida or Bitter-Apple. This consists of a thin yellow or orange rind, leathery when fresh, but brittle when dry, and of a cellular pith or pulp, which is white, and contains numerous, oval, flattened white seeds. The officinal part is the dry pulp only, which is imported sometimes with the rind, that is in the form of the entire fruit, [Mogadore Colocynth], but much more commonly peeled [Turkey Colocynth], and of late sometimes without the seeds. The colocynth of English commerce is supplied chiefly from the ports of the Levant and the Mediterranean coast of Africa. The best kind is peeled, very white, light and spongy, of moderate size, and without seeds. The common sort contains the seeds. The pith of the larger fruits, or that which is grayish or brownish, is of inferior quality. The seeds are placed in the intervals between the sections of the pulp, which are six in number. Their weight is about three-fourths of the fruit stripped of its rind. They are said by some authors to be bland, and to be used as food in northern Africa (Captain Lyon); but those taken from the dried fruit brought to this country, however carefully washed, partake slightly of the bitterness of the pulp.

Chemical History.—The pulp has scarcely any odour, but a powerful, disagreeable, bitter taste. It is reduced to powder with difficulty. Water and alcohol readily remove its bitterness and acquire its active properties. The former is the officinal menstruum for preparing the *Extractum colocynthidis.* Cold water removes only sixteen per cent from the pulp. Boiling water, which is directed to be used for making the extract, takes up 45 per cent (Duncan). The proportion of water ordered by the Dublin College for the purpose is too small (Phillips); for a thick pulp is formed, owing to pectic acid being dissolved (Braconnot). The extract is pale-brown, translucent, elastic, and intensely bitter. The *Extractum colocynthidis compositum* of the English and Irish Pharmacopœias, which scarcely differs from the *Pilula colocynthidis* of the Colleges of Edinburgh and Dublin, and which consists of various other purgatives besides colocynth, is in practice the most familiar form of this drug, and one most extensively employed at present in Britain. The best excipient for this pill-mass is, neither mucilage nor treacle which have been commonly used for the purpose, but rectified spirit as now directed by the Edinburgh College; for there is nothing else which keeps the pill so long soft without adding inconveniently to its bulk. Colocynth pulp contains, according to Meissner, 20 per cent of various gummy principles, 13.2 resin insoluble in ether, 4.2 fixed oil, 10 extractive matter, 5.7 phosphates of lime and magnesia, 19.2 lignin, a little moisture, and 14.4 of Colocynthin. This name was first given by Vauquelin to a pale yellow, transparent, brittle substance, soluble in water, alcohol, and ether, precipitable

from its watery solution by tannin, of intense bitterness, and possessing violent purgative properties. It is obtained from the watery extract by means of alcohol, and farther means of purification. But it has been incorrectly named; for it cannot be properly considered a pure proximate principle.

Actions and Uses.—Colocynth is a powerful irritant and cathartic. It is a dangerous poison in moderate doses, and has been sometimes used as such in this country under its vernacular name of Bitter-apple. It excites inflammation of the intestinal mucous membrane, like other vegetable irritants. In small doses it is one of the most powerful hydragogue cathartics in the Materia Medica; and it seems to possess no other action except what is secondary to that effect. It is never used alone, because its violence is greatly mitigated, while its efficacy and certainty are not impaired, by uniting it with other cathartics, such as aloes and scammony. Of this nature are the compound extract and pill, the most useful perhaps of purgatives for general use, and more in vogue at present in Britain than almost any other. A great improvement however upon these preparations is the *Pilula colocynthidis et hyoscyami* of the Edinburgh Pharmacopœia, in which the compound extract, by the addition of half its weight of extract of hyoscyamus, is almost entirely deprived of its tendency to gripe, or to irritate the rectum. This pill is much improved by substituting Barbados aloes for the Socotorine kind, and by reducing the size of the pills to two grains only.

The doses of the preparations of colocynth are, *Extractum colocynthidis*, gr. v. ad gr. x. *Extractum colocynthidis compositum*, L. D. gr. v. ad. gr. xv. *Pilulæ colocynthidis*, E. (*compositæ*, D.) gr. v. ad. gr. xv. *Pilulæ colocynthidis et hyoscyami*, E. gr. v. ad gr. xv.

CONIUM, *E. D.* CONII FOLIA, *L.* *Leaves of Conium maculatum, L. W. DC. Spr.* *Hemlock.*

TESTS, *Edin.* The powder triturated with Aqua potassæ, exhales a powderful odour of conia.

CONII FRUCTUS, *L.* *Fruit of Conium maculatum, &c.*

EXTRACTUM CONII, E. L. SUCCUS SPISSATUS CONII, D.

PROCESS, *Edin.* Take of
Conium, any convenient quantity; beat it into a uniform pulp in a marble mortar,* express the juice and filter it. Let this juice be evaporated to the consistence of firm extract either in a vacuum with the aid of heat, or spontaneously in shallow vessels exposed to a strong current of air freed of dust by gauze screens.

This extract is of good quality only when a very strong odour of conia is disengaged by degrees on its being carefully triturated with Aqua potassæ.

PROCESS, *Lond. Dub.* To be made from fresh leaves, like extract of Monkshood.

PILULÆ CONII COMPOSITÆ, L.

PROCESS, *Lond.* Take of
Extract of hemlock, five drachms;
Powder of ipecacuan, one drachm;
Mucilage of acacia, a sufficiency.
Beat them into a uniform mass.

TINCTURA CONII, E. L. D.

PROCESS, *Edin.* Take of
Fresh conium-leaves, twelve ounces ;
Tincture of cardamom, half a pint ;
Rectified spirit, a pint and a half.
Bruise the leaves, express the juice strongly ; bruise the residuum, pack it firmly in a percolator ; transmit first the tincture of cardamom, and then the rectified spirit, allowing the spirituous liquors to mix with the expressed juice as they pass through ; add gently water enough to the percolator for pushing through the spirit left in the residuum.
Filter the liquor after agitation.

PROCESS, *Lond. Dub.* Take of
Dried conium leaves, five ounces (two, D.) ;
Cardamom, bruised, an ounce ;
Proof-spirit, two pints (a pound by measure, D.)
Macerate for fourteen days (seven, D.) and strain.

UNGUENTUM CONII, D.

PROCESS, *Dub.* Take of
Fresh conium leaves, and
Prepared lard, of each two pounds.
Boil the leaves in the lard till they shrivel ; strain through linen.

CATAPLASMA CONII, D.

PROCESS, *Dub.* Take of
Dried conium leaves, an ounce ;
Water a pound and a half by measure.
Boil down to a pound and add to the strained liquor enough of the same powder to make a poultice.

FOR. NAMES.—*Fren.* Grande cigue.—*Ital.* Cicuta maggiore.—*Span.* Cicuta ; Ceguda.—*Port.* Cigude.—*Ger.* Gefleckte Schierling.—*Dut.* Dollekervel ; Scheerling.—*Swed.* Spräklig odört.—*Dan.* Skarntyde.—*Russ.* Boligolov piatnistoi.

FIGURES of Conium maculatum in Hayne, i. 31.—Nees von E. 282.—Steph. and Ch. i. 13.

IT is not clearly ascertained at what time HEMLOCK was introduced into the Materia Medica. Doubts exist whether the ancient Κωνειον was the modern hemlock. The description of Dioscorides does not apply to the *Conium maculatum* of botanists. But the action of this plant as a poison, ascertained only in recent times, corresponds closely with the description given by Nicander and Plato of the κωνειον or state-poison of the Greeks. Hemlock was little used in modern physic till Störck recommended it in 1762 as a remedy for cancerous diseases and glandular swellings.

Natural History.—The plant is a biennial, belonging to the natural family *Umbelliferæ* and to Linnæus's class and order *Pentandria Digynia.* It is met with abundantly in this country, as well as in most parts of the continent, along hedges and roadsides, and on exposed banks of rubbish. In its first season it consists of a long slender root and a few small root-leaves spread flat upon the ground. Early in its second summer it has a solid, white, ligneous and amylaceous root towards two feet or upwards in length ; and it afterwards pushes up a flowering stem commonly between two and four feet, sometimes even six feet, in height, hollow, jointed, and speckled with numerous dark purple spots. Its leaf-stalks are similarly speckled. The fruit which ripens in August and September is plano-convex, with five undulated ridges on its convexity. The whole plant is smooth and destitute of hairs or down. It emits, especially in sunshine, a strong peculiar odour like that of mice,—which by many authors has been incorrectly likened to that of cat's urine. It bears a general resemblance to various umbelli-

ferous plants, and has been confounded by the unskilful with *Æthusa Cynapium, Œnanthe crocata, Cicuta virosa, Myrrhis odorata*, *Myrrhis temulenta*, and some others. In its second summer it may be easily distinguished by its purple-spotted stem and leaf-stalks from every species except the *Myrrhis temulenta*. a common inhabitant of roadsides; and that species is at once known from it by every part of the plant being hairy. In its first season, and also in its second until the month of May, when it first begins to push up its flowering stem, the leaf-stalks are seldom spotted; in which condition its best character, for those not familiar with its appearance, is the strong peculiar odour exhaled when the leaves are bruised with solution of potash.

The leaves have been adopted as the officinal part of the plant by all the British Colleges, and the fruit has been added by that of London. It has been generally held on the authority of Fothergill, that the leaves are in the most active state, and ought therefore to be gathered for medical use, when the plant is in full flower, or even a little later when the flower is passing away and the fruit is forming. This rule is far from being so certain as many think. In Fothergill's time there was not any good criterion known for ascertaining the point in question. And from such experiments as I have made on its poisonous properties there would appear to be no great difference at any season; for even in November and March of its first year its activity is very great. In truth, neither the effect of season, nor that of other circumstances in vegetation on the activity of hemlock, has been hitherto successfully investigated. Mérat has dwelt much upon the influence of climate on its energy; but all the facts collected on this head are extremely vague, and vitiated by the ignorance which prevailed till quite recently of the conditions necessary for preparing the plant for use. ——The fruit, as stated by Geiger, is much more active than the leaves; but, contrary to his opinion, it is considerably more active when green than when ripe and dry. The difference subsisting between the leaves and fruit in energy is an objection to the adoption of the latter by the London College as an article of the Materia Medica, unless it were used for some special purpose different from those to which the leaves are applied.

Chemical History.—Hemlock-leaves have a beautiful deep green colour when fresh, and a peculiar, nauseous, saline, and somewhat acrid taste. They emit a strong mousy odour in the course of being dried, lose at the same time some of their activity, and acquire a dark grayish-green tint. They lose their energy altogether in time, but not so quickly as is commonly thought; for I have found them, when carefully kept, active enough for at least two years. They are best preserved by drying them perfectly at a temperature not much above 120° and then putting them into well-closed bottles or jars. A temperature of 212° or a little higher destroys their active part entirely if long-continued. Hence the preparation of

their most familiar and important officinal form, the inspissated juice, or *Extractum conii*, is a matter of some nicety to manage. The common mode of making it, by evaporating the inspissated juice over a vapour-bath or naked fire, is faulty; because towards the close, even over the vapour-bath, and at all times if the juice be boiled, the active principle quickly undergoes decomposition,—of which the operator is apprized by the disengagement of a strong odour of ammonia, mingled with the peculiar mousy odour of the plant. A very superior extract may be prepared, as the Edinburgh Pharmacopœia directs, either by evaporation in a vacuum according to the process first successfully applied to practice by Mr Barry, or by spontaneous evaporation in shallow vessels exposed to a current of air, or still better perhaps, according to a method pursued by the Messrs Smith of this city, by concentrating the expressed juice to a thin syrup in vacuo, and then finishing the evaporation spontaneously. The extract, if well prepared, has a fine deep green colour when spread upon paper. It may be kept for a long time without material loss in activity. But in the course of years it becomes inert, howsoever it may be made,—even the extract of Mr Barry being rendered at length inactive, as I have ascertained.

Hemlock-leaves when subjected to a strong decomposing heat yield an empyreumatic oil, which is very poisonous, and probably owes its properties to the active principle of the plant passing over in part without decomposition. They readily yield their virtues to water, alcohol, and proof-spirit. If they are boiled with water, a minute proportion of an aromatic volatile oil passes over, which Geiger found not to be poisonous. In this respect hemlock presents one of the most distinguishing characters of the Family to which it belongs. Spirit is the menstruum used for making the officinal *Tinctura conii.* This is best made, not from dried leaves according to the usual practice, but from fresh leaves by expressing the juice, transmitting rectified spirit through the residuum, mixing the watery and spirituous fluids, and filtering the product. The Edinburgh College has alone adopted this method; which, when carefully followed, probably yields the best of all preparations of hemlock for medicinal use. Of late it has been proposed to substitute for the ordinary tinctures one made by adding a fourth part of rectified spirit to the expressed juice without exhausting the residuum (Squire, Bentley); and this must also be a very good preparation. The tincture obtained by percolation yields a superior extract by distilling off the spirit, and concentrating what remains over the vapour-bath, with constant stirring till an ammoniacal odour begins to be disengaged. On then allowing the residue to cool, a firm deep green extract is obtained, which possesses great energy, and retains it unimpaired for at least four years. An alcoholic extract would therefore be the best variety of this preparation. Hemlock leaves part with their properties to oils and fats;

so that the Dublin College has introduced, not without reason, an *Unguentum conii* into its Pharmacopœia.

If the fresh or dried leaves of hemlock, their expressed juice, the green or ripe seeds, or any of the officinal preparations, be triturated with solution of potash, there is slowly emitted an intense peculiar odour, somewhat like that of ammonia; which arises from the disengagement of the active principle of the plant. This principle the Coneïn, Conicin, or Conia of chemists, was first discovered and carefully examined by Geiger in 1831, and proved by him to be an oleaginous, volatile alkaloid, possessing extraordinary energy as a poison. It is most easily obtained by cautiously distilling from a muriate of lime bath a mixture of strong solution of potash with the alcoholic extract of the unripe fruit. The alkaloid passes over with the water and floats upon it like an oil. The ordinary method, by which it is obtained more cheaply, is to distil the full-grown, but still green, fruit with water, caustic potash, and slaked lime, from a muriate of lime bath,—to neutralize the distilled fluid with sulphuric acid and concentrate the solution to a thin extract,—to act on this with a mixture of two parts of rectified spirit and one of sulphuric ether, and obtain an extract again from this solution,—and finally to distil the extract with a strong solution of potash. As obtained in either of these ways conia contains some water, which may be removed by chloride of calcium,—and also a little ammonia which is separated by keeping it for a few hours in vacuo. It is at first colourless, but is very prone to become brown by oxidation. It has an intense, peculiar, suffocating odour, and an extremely acrid, benumbing taste. Exposed to the air, it gradually becomes brown, disengages ammonia, deposits a resinous matter, and loses much of its activity. It boils at 370° and may be distilled in close vessels without alteration. It distils over with water at 212° like the volatile oils. It is sparingly soluble in water; but water unites with it in the proportion of about a fourth part to form a hydrate. It is very soluble in alcohol and ether, in the fixed and volatile oils, and also in weak acids, which it neutralizes. Its salts have not as yet been crystallized. Its constitution is $C^{16} H^{16} N$ (Ortigosa.) It exists in the greatest abundance in the full-grown, green fruit; the ripe fruit contains less; the leaves still less; and the root very little. Eight pounds of green fruit will yield half an ounce of hydrated conia; but they contain much more, for a large proportion is obviously decomposed in the process.

Adulterations.—The common officinal preparations of hemlock,—its leaves and extract,—though not perhaps subject to adulteration, are often of inferior quality, owing to their having been unskilfully prepared, or kept too long or carelessly. I have found several samples in the shops quite destitute of conia; and all pharmacologists agree that the common extracts are very variable in their effects as poisons, and are often so inert that they can be of no use as medicinal agents. The best and only satisfactory crite-

rion of their quality, as the Edinburgh College has usefully pointed out, is the strength of the odour of conia disengaged on triturating them with Aqua potassæ. In Germany the leaves have been observed to be adulterated with those of *Achillea millefolium* and *Myrrhis temulenta.* The former have a peculiar aromatic odour, the latter are hairy; and if these characters be not sufficient for detecting them, trituration with potash may be resorted to.

Actions and Uses.—The Actions of hemlock have been long misunderstood. It has been known immemorially as a narcotic poison of great virulence; and it was supposed to excite convulsions and fatal coma, to render the blood fluid, and to exhaust the irritability of the heart. I have endeavoured on the contrary to show, that it leaves the heart's action unimpaired, and does not prevent the blood from coagulating, any more than other causes of death by asphyxia,—that it does not excite convulsive spasms or bring on insensibility,—but that it exhausts the nervous energy of the spinal chord and voluntary muscles, occasioning merely convulsive tremors and slight twitches, and eventually general paralysis of the muscles and consequent stoppage of the breathing (Trans. Roy. Soc. Edin. 1836.) This view has been substantiated by a remarkable case of poisoning with hemlock, which lately occurred in Edinburgh, and has been accurately described by Dr Bennett. Paralysis without convulsions or coma, was the only evident phenomenon. I was unable to detect the active principle in the blood in animals poisoned with it; but Mr Judd has since been more fortunate. Mr Judd's observations on its poisonous properties do not exactly correspond with the view now given of them; and among other statements, he remarked that the contractility of the heart is powerfully affected. I apprehend, that the most essential differences between us arise from his not having appreciated precisely the phenomena, which are intricate and difficult to follow. The effects of hemlock in medicinal doses are very imperfectly known. Since the time when it was currently adopted as a remedy in consequence of the recommendations of Störck, it has been generally thought to be, when administered internally, an anodyne, hypnotic and calmative, as well as to possess important deobstruent properties, especially in malignant tumours and ulcerations. It has likewise been held to be a diuretic, to diminish the venereal appetite, and to lessen the secretion of milk. Hence it has been employed in scirrhus, in cancerous and other malignant ulcers, in strumous sores and enlargement of the glands, in pseudo-syphilitic ulcers, eruptions and nodes, in chronic enlargements of the liver and spleen, in chronic catarrh, asthma and hooping cough, and in neuralgia of all kinds. But the deobstruent virtues of hemlock are now almost universally discredited; its diuretic action is too unimportant to be available in practice; and little faith can be attached to what has been said by our predecessors of its influence in diseases of the nervous system, because the preparations they used were often inert, and the doses

they administered too small to produce positive effects even though the preparations had been of good quality. The only careful investigations made since the conditions for obtaining good and uniform preparations were known are those of Mr Judd (Med. Bot. Trans. 1839) and Dr Neligan: Mr Judd infers from experiments with medicinal doses upon cats and other animals, that a well-made extract causes great languor and drowsiness and often profound sleep for two or three hours, lessens muscular excitability, and reduces the circulation as well as the animal heat. He is therefore inclined to believe that hemlock really deserves the reputation it has enjoyed with many of being an efficient anodyne and hypnotic; he adds, that in some trials with it in patients affected with pectoral complaints he found it to have a salutary effect in allaying cough and promoting sleep; and he thinks it peculiarly applicable to the treatment of hypertrophy of the heart, phrenitis, and other affections attended with an excited or excitable state of the circulation. Dr Neligan found it to lessen nervous excitement and muscular pains, and to be useful in chronic and subacute rheumatism, neuralgia and gangrena senilis. The few trials I have myself made with well-prepared extracts have not yielded such favourable results. I have occasionally found it to appearance useful as an anodyne and calmative in scirrhous uterus, but cannot say much for its virtues as such in neuralgic affections. On the whole it appears to me that the entire subject of the medicinal actions and uses of hemlock requires to be investigated anew; and it well deserves investigation, considering its singular energy and peculiar effects as a poison.

Hemlock is sometimes used externally. A poultice of hemlock leaves, or an ointment of the same, for each of which the Dublin College has given convenient formulæ, appears often to relieve, more than any thing else, the lancinating pains of cancerous ulceration; and they will sometimes also mitigate external neuralgic disorders.

Conia, the alkaloid of hemlock, has not yet been used as a medicine. But it is a most energetic poison, possessing the same remarkable action on the spinal chord as hemlock itself. A few drops will kill a small animal, such as a rabbit, cat, or puppy, in a few minutes, and the effects are gradual paralysis, slight convulsive tremors, and death from suspension of the breathing, without any alteration in the appearance of the blood, and without any depression of the action of the heart. It acts with greatest energy where absorption is most rapid. Its salts are even more energetic than the alkaloid itself, because they are more soluble (Edin. Roy. Soc. Trans. 1836).

The doses of the preparations of hemlock are not well determined. Mr Judd gave four grains of a strong extract. I have given so much as six grains even of the alcoholic extract thrice a-day without distinct effects; but I have seen the same dose cause trouble-

some giddiness and some headache. The dose of the tincture is probably from half a drachm to a whole drachm.

CONTRAJERVA, L. *Root of Dorstenia Contrajerva, L. W.* *Contrajerva.*

FOR. NAMES.—*Fren.* Racine de contrajerva.—*Ital.* Contrayerba.—*Span.* Contrayerba.—*Port.* Contraherva.—*Ger.* Contrajerva-wurzel; Giftwurzel.
FIGURE of Dorstenia Contrajerva in Nees von E. 98.

CONTRAJERVA was made known in the beginning of the seventeenth century by Clusius, as a valuable tonic and aromatic, which possessed in South America the reputation of preventing the effects of the bite of venomous snakes. Its name was derived from its supposed antidotal properties (*herba contra venenum*). It has now fallen into disuse, and is retained only by the London College in this country as an officinal simple.

Natural History.—The plant belongs to Linnaeus's class and order *Monœcia Tetrandria*, and to the Natural family *Urticaceæ*. It is a small herbaceous plant, inhabiting the West-Indian Islands and adjacent continent of America. The officinal part is the root, which consists of a woody rhizoma, surrounded by numerous slender fibres. The rhizoma is about half an inch thick, and from one to three inches long, scaly, knotty, and wrinkled, grayish or reddish brown externally, paler within, rather hard, and brittle. It has a strong aromatic, bitterish, acrid taste, and a peculiar corresponding odour. It has not been carefully analysed; but it contains an acrid volatile oil, a considerable proportion of starch, and according to some a little tannin. It makes a thick mucilaginous decoction, which is rendered bluish-black by tincture of iodine.

Although the London College has admitted only the *Dorstenia Contrajerva* as the source of officinal contrajerva, there can be little doubt that the drug is obtained from several allied species, among which may be mentioned on the authority of Martius, the *D. Houstonii, Drakena* and *Braziliensis*; and the last species has been held to produce the best quality of the root.

Actions and Uses.—Contrajerva is probably a good aromatic tonic. It has also been considered vermifuge. And its supposed antidotal properties, which brought it into notice in America, have been held to apply in Europe to infectious diseases. English physicians at the beginning of last century used it in typhus and other malignant fevers to correct putrescency of the fluids. Huxham thought it promoted the action of the cutaneous exhalants, and gave it to promote the eruption of various exanthematic fevers. An infusion has been used as a gargle in malignant sore throat and foul ulcers of the mouth and throat. It is probably not a bad carminative tonic in dyspepsia attended with flatulence.

It is given in powder in the dose of one, two, or three scruples.

CONVOLVULUS JALAPA, D. See *Jalapa*.

CONVOLVULUS SCAMMONEA, D. See *Scammonium*.

COPAIBA, *Fluid resinous exudation of various species of Copaifera, L. W. DC. Spr. (Edin.)—of Copaifera Langsdorfii, DC. (Lond.)—of Copaifera officinalis, L. (Dub.) Copaiva.*

TESTS. *Edin.* Transparent: free of turpentine odour when heated: soluble in two parts of alcohol: it dissolves a fourth of its weight of carbonate of magnesia, with the aid of a gentle heat, and continues translucent.

COPAIBAE OLEUM, E. *Volatile oil of Copaiva. See Copaiba.*

FOR. NAMES.—*Fren.* Baume de Copahu.—*Ital.* Balsamo copaiba; Balsamo copau.—*Span.* and *Port.* Balsamo de copayva.—*Ger.* Copaiva-balsam.—*Dut.* Balsem copayve.—*Swed.* Hwit Indiansk balsam.—*Dan.* Copaiva balsom.—*Russ.* Kopaevoe.

FIGURES of twelve species of Copaifera in Hayne, x. 12 to 23. Four of these, namely, C. bijuga, coriacea, Martii, and Langsdorffii, in Nees von. E. Suppl. 85 to 88. One, namely, C. Jacquini, as C. officinalis in Steph. and Ch. iii. 158.

COPAIVA, or Balsam of Copaiva, was first made known in Europe about two centuries ago by Marcgrav and Piso as a resinous exudation obtained by incisions from a tree inhabiting Brazil.

Natural History.—Its botanical source is a complex and difficult subject. In 1763, Jacquin was the first who ascertained that one variety of the drug is produced on the islands of Martinique and Trinidad from a tree named by himself *Copaiva officinalis*, but which Linnæus afterwards called *Copaifera officinalis*. This plant however yields only what is called Island or West-Indian copaiva, a kind in little estimation, and not much seen in English commerce. In 1821, Desfontaines described Jacquin's species more precisely under the name, now generally adopted, of *C. Jacquini;* ascertained it to be a native of Venezuela as well as of the West-Indian islands; and also proved that the more esteemed copaiva of Brazil is produced by two other species, *C. Guianensis*, an inhabitant of the district of Rio Negro in Brazilian Guiana, and *C. Langsdorffii*, so named from a botanist who sent him specimens of the plant used for obtaining the drug in the district of San Paulo in southern Brazil. In 1823, the botanical traveller Martius confirmed the statements of Desfontaines; and likewise discovered that two additional species, *C. coriacea* in the district of San Paulo, and *C. multijuga* in the province of Para, on the river Amazon, are used in their respective localities for obtaining the drug, and that two others, *C. nitida* and *C. oblongifolia* yield an inferior article in the inland Brazilian provinces of Minas Geraës and Goyaz. In 1827, Hayne investigated the whole subject anew, in reference to the prior researches of Desfontaines and Martius, and with the aid of specimens from the herbariums of Willdenow and Hornemann, as well

as others communicated by Martius, Beyrich, and Sellow, who had all visited Brazil. And he established, besides the species already mentioned, no fewer than eight others indigenous in Brazil, which are all capable of yielding copaiva. These are, *C. Beyrichii* from the mountains of Estrella in Mandiocca, *C. Martii* from the province of Para, *C. cordifolia* and *Sellowii* from the forests of Catinga in Bahia, *C. laxa* from Minas Geraës, and *C. bijuga, trapezifolia,* and *Jussieuii,* whose exact localities have not been determined. It is not positively known which of all these fifteen species yield the copaivas of European commerce. But it seems probable that *C. Jacquinii* is the sole source of West-Indian copaiva; that *C. bijuga* alone corresponds with the description given by Marcgrav and Piso of their copaiva-plant; and that the fine Brazilian variety of the present day is obtained from *C. multijuga* and *C. Martii* in the province of Para, *C. Guianensis* in the province of Guiana, *C. Langsdorffii* and *C. coriacea* in the province of San Paulo, and possibly from other species. Later inquiries render it probable that fine copaiva is obtained from *C. trapezifolia* in the district of Macahé (Redwood). Farther, specimens of copaiva have been repeatedly sent to this country from British Guiana, differing, according to those in my possession, from the common copaiva of the shops, and represented to be produced by plants growing farther north, near the Orinoco, whose species botanists have not yet determined. There is no ground therefore for the restricted view of the botanical source of copaiva taken by the College of London, which acknowledges only one species, the *Copaifera Langsdorffii.* The botanical reference of the Dublin Pharmacopœia is altogether obsolete.

The Brazilian species which yield the finer qualities of copaiva are fine trees, from thirty to forty feet high. The others which inhabit the inland and drier territories of Bahia, Minas Geraës, and Goyaz, are small shrubs; and yield a darker, more resinous, and less abundant exudation. The drug is obtained from deep incisions made into the trunk of the trees in the wet season or immediately afterwards; the incisions either heal spontaneously or are closed with wax or with clay; and often two operations are performed annually. Some trees so abound in resinous juice that they will yield twelve pounds in the short space of three hours.

Chemical History.—The Copaiva of commerce presents a considerable variety of appearances, as may be naturally expected from the multiplicity of its botanical sources. Two kinds are commonly distinguished, West Indian and Brazil Copaiva. The Orinoco kind probably constitutes a third; but I am not aware that it is yet met with in commerce. Brazil copaiva, the most esteemed variety, and the only one in request in British trade, is rather thinner in consistence than new honey, transparent, pale wine-yellow in colour, of a peculiar, resinous, not unpleasant odour, and of a bitter, somewhat acrid, aromatic, persistent taste. The West Indian variety is of

thicker consistence, darker wine-yellow, sometimes brownish-yellow, turbid but translucent, of a less agreeable and more terebinthine odour, and more bitter and acrid in taste.. Of the specimens of Orinoco copaiva in my possession one is wine-yellow and turbid, another pale brownish-yellow and transparent; but both in other respects closely resemble Brazil copaiva.

Copaiva has a density of 950. When long kept, especially under exposure to the air, it becomes darker, more dense, and of much thicker consistence; and after some years its resin partly crystallizes in minute six-sided prisms. Heat disengages a volatile oil and leaves a resin; but these principles cannot be easily detached in this way, as an elevated temperature is required. Water does not dissolve copaiva, but acquires its odour. It is moderately soluble in rectified spirit, and freely so in alcohol, fixed as well as volatile oils, sulphuric ether, and spirit of nitrous ether. It dissolves iodine, and also sulphur with the aid of heat. Sulphuric acid seems to unite with it, rendering it reddish-brown and thicker. Solution of potash combines with it to form a soap. Three parts of copaiva, one of potash, and two of water, form a clear solution which is rendered turbid by considerable dilution. Ammonia in solution has a similar action: Five parts of copaiva and one of the weaker Aqua ammoniæ of the Pharmacopœias form a clear solution; but it is decomposed when moderately diluted. Magnesia and even its carbonate are freely dissolved by it, especially with the aid of heat; carbonic acid in the latter case is disengaged; and there is produced a honey-like translucent mass which gradually hardens. In these actions with bases, chemical compounds are formed, in which the copaiva itself or its resin acts the part of an acid.

According to the views of some chemists copaiva is itself a proximate principle. But it is more generally considered a compound of resin and volatile oil. It is not a balsam in the strict signification of that term, although called so in common speech; for it does not contain benzoïc acid, and has not the fine fragrance of the true balsams. Its oil, which is officinal, is best obtained by distillation with water. This oil has an intense pure odour of copaiva when thus prepared; but that usually sold in the shops has a different, somewhat empyreumatic odour, as if it had been obtained, like coarse oil of turpentine, by dry distillation. It is colourless when prepared from the copaiva of the shops, but pale yellow when obtained from the Orinoco kind. Its density is 910. It boils about 470°. It is very soluble in alcohol and ether. It absorbs muriatic acid gas; and crystals of artificial camphor are formed, as with oil of turpentine. It seems identical in composition with pure oil of turpentine, being composed of ten equivalents of carbon and eight of hydrogen (Blanchet).——When the oil is all separated by distillation with water, a resinous matter remains in the mattrass, which becomes hard in cold, but continues soft in warm, weather. It consists of a large proportion of a hard yellow resin, soluble in naphtha, as well

as in alcohol, ether, fixed oils and volatile oils, and capable of combining as an acid with bases, (Copaivic acid)—and of a small proportion of a soft brown resin, always unctuous, which has little or no affinity with bases, and which, being insoluble in naphtha, is easily separated by this fluid from the hard resin.——The volatile oil is most abundant in fresh copaiva, and the soft resin in that which is old. Different accounts have been given of the proportions of its principles to one another. Stolze found 45.6 per cent of volatile oil, 52.7 hard resin, and 1.7 soft resin. Gerber obtained from a fresh sample 41 of oil, 51.4 hard resin, 2.2 soft resin, and from an old one 31.7 oil, 53.7 hard resin, 11.1 soft resin, besides 4 or 5 per cent of water from both.

Adulterations.—The copaiva of the shops is frequently spurious. The coarse kinds are sometimes substituted for the finer qualities; and both are subject to be adulterated with oil of turpentine or with fixed oils, such as poppy-seed-oil and still more castor-oil. Of late the distilled-oil of the Gurjun balsam, the produce of some species of *Dipterocarpus*, has been used for this purpose (Redwood). The inferior but unadulterated kinds are recognised by their relative colour, opacity, and thickness. If turpentine or other volatile oil be present even in small proportion, it may be detected by its odour, especially on applying gentle heat. Any fixed oil but castor-oil may be discovered by agitation with absolute alcohol; for, instead of a clear and permanent solution being obtained, a turbid mixture results, from which the impurity slowly separates. A better test however, because it detects castor-oil also, is the action of carbonate of magnesia aided by a gentle heat. Pure copaiva dissolves a fourth of its weight of the carbonate and remains translucent; but a small proportion of any fixed oil renders the product opaque (Mialhe). Another method long in use is to triturate the suspected article with sulphuric acid, which reddens pure copaiva, but does not alter its colour if any fixed oil be present. Another test is the action of solution of potash. Nine parts of pure copaiva shaken with a solution of one part of potash in two of water form a clear liquid, which continues permanently so after moderate dilution with water or rectified-spirit; but if the copaiva contain a sixth of fixed oil, the alkaline compound is never clear, and with half that amount of impurity white flakes are precipitated in a few hours (Stolze). Ammonia, proposed by Schweitzer instead of potash, I have found not to answer. It will not indicate even so large a proportion as a sixth of castor-oil. All these tests indeed are open to sources of fallacy when taken singly. Mr Redwood therefore recommends to test the purity of copaiva, by determining how much oil it yields by distillation.

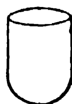
Actions and Uses.—Copaiva is in large doses an irritant; which is scarcely so active however as to deserve the name of a poison. In medicinal doses it is a stimulant, cathartic, and diuretic; and

therapeutically it possesses the property of diminishing excessive mucous discharges and arresting intermittent fever. It is absorbed in the course of its action and communicates to the urine its bitter taste and a peculiar odour.

It is scarcely ever used as a purgative or diuretic; but these effects are often developed during its curative action in diseases of the mucous membranes. About the beginning of last century it was used with apparent success as a febrifuge in ague. This application of it has been long abandoned; and the principal purpose for which it is now employed is in the treatment of mucous inflammations, particularly gonorrhœa and bronchitis. Its general adoption in gonorrhœa dates from the commencement of last century; and it is still the most approved remedy for that disease. For a long time it was thought applicable only to the chronic stage; but it is now known to be equally safe and fully more certain during the acute and incipient stage. The chief contraindication arises from the presence of unusually violent urethral inflammation, or of sympathetic bubo or hernia humoralis; yet some use it even in such circumstances, and the previous employment of blood-letting, with other antiphlogistics, will commonly render it safe. Its therapeutic effect is often observed to be attended with a mild cathartic operation; which may therefore be usefully encouraged by laxatives. Its effect in acute cases often begins in two or three days, and may be perfected in three or four days more. It should be continued for security about a week after the disappearance of the discharge.—Simmons and Armstrong in Britain and Hallé in France seem to have been among the first to establish its efficacy in chronic catarrh; in which it continues to be an approved remedy with some. It is not so serviceable in other mucous discharges, but appears at times useful in leucorrhœa and catarrh of the urinary bladder. Its mode of action in arresting excessive mucous discharges is not well ascertained; but it is supposed to act by calling forth a different kind of excitement of the membrane, which amounts at times to slight inflammation.—The volatile oil contained in copaiva is probably its active part. This is doubted by some, and a few even insist on the contrary that the active principle is the resin. But some of the "Specific Solutions" sold in the shops, and which are undoubtedly efficacious, contain chiefly the volatile oil; the pure oil is itself an active remedy; and it is remarkable that all the best remedies for gonorrhœa are either volatile oils, or contain one.

Copaiva is most generally administered by the mouth, but sometimes in the way of clyster. It is often given in too small doses. They ought not to be less than half a drachm; and an entire drachm, given twice or thrice a-day, is the most appropriate quantity. As it is a nauseous medicine on account of the quality, permanence and adhesiveness of its taste, various devices have been contrived for facilitating its administration. Some take it simply in water, which

is stirred briskly so as to collect the copaiva in a globule in the centre. A better plan is to make it into an emulsion. For this purpose each drachm may be triturated with the yolk of one egg, to which are afterwards to be added half an ounce of some aromatic such as peppermint or cinnamon water, and then as much simple water as pleases the patient; or the copaiva may be dissolved in its own volume of spirit of nitrous ether, and then agitated with twice as much mucilage and four times as much water.——A favourite method of giving copaiva in recent times is in the form of boluses made by inclosing the drug in thin capsules of gelatin, which are dissolved in the stomach. This ingenious plan was contrived a few years ago in Paris by M. Mothes. The capsules may be made in the following manner. The body is formed of this size and shape by rounding very smoothly the end of a cylinder of iron or hard wood four lines in diameter and a few inches in length, dipping half an inch of this end into a saturated alcoholic solution of soap kept warm, then dipping it, when the layer of soap has concreted, into a strong hot solution of gelatin once or oftener according to the thickness desired, and lastly removing the capsule by a screwing motion when the gelatin is quite dry. The top is made in the same way, but shorter and a trifle wider; and when the body is filled and the top slipped over it, they are united by rubbing over the line of junction a camel's hair-brush moistened with hot water (Feder, in Buchner's Repertorium). The form of pill, which however is ineligible on account of its insolubility, is best attained by sprinkling one part of calcined magnesia into sixteen parts of copaiva in a flat plate and letting the compound stand till it thickens sufficiently to be worked into the proper shape. For some time past it has become fashionable in Britain to use what are called Specific Solutions of Copaiva; for which every druggist has his formula, and which have the advantage of presenting the drug in a state of solution and capable of being diluted without being decomposed. They are commonly made with solution of potash and spirit of nitrous ether; and the following is a convenient formula in use in this city. Boil gently for fifteen minutes two ounces of copaiva with two ounces and a half of potash-solution; add, when nearly cool, an ounce of spirit of nitrous ether; and when the mixture has been at rest for twelve hours, remove the intermediate liquid from the soapy sediment which falls and the lighter fluid which floats on the surface. In these preparations a part of the volatile oil seems to be separated, and most of the resin deposited in the form of soap.——M. Velpeau not long ago proposed to administer copaiva in the way of clyster instead of by the mouth. He found it very efficacious when given in divided doses to the extent of an ounce daily in the form of emulsion, to which a little laudanum was added to prevent its too speedy discharge from the gut.——Many now prefer the pure volatile oil to any form for administering the



crude drug; and though some call in question its superiority, and a few even doubt its efficacy altogether, I am satisfied from observation, as well as many reports from medical friends, that it is at least as effectual as copaiva, efficacious in less doses, and not so apt to occasion sickness. It is best given in emulsion, composed of equal parts of the oil, of rectified spirit, peppermint or cinnamon water, and syrup or mucilage.

Among the inconveniences attending the use of copaiva, sickness and vomiting are the most frequent. This effect may sometimes be prevented by multiplying but diminishing the doses, by altering the form, especially to that of solution, by uniting an aromatic water with it, or by directing the patient to chew a piece of cinnamon or nutmeg after each dose. It often produces a transient papular eruption on the skin. Occasionally a sharp febrile attack is occasioned when the medicine has been taken for some days in gonorrhœa; but as this attack goes off with perspiration in twenty-four or thirty-six hours and is commonly attended with arrestment of the discharge, it ought not to occasion annoyance, and scarcely requires any treatment.

The doses of the preparations of copaiva are *Copaiva*, m. xv. ad fl.scr. iv. *Copaivæ oleum*, E. m. v. ad m. xxx.

CORIANDRUM. *Fruit* (*seeds*, *D.*) *of Coriandrum sativum*, *L. W. DC. Spr. Coriander.*

FOR. NAMES.—*Fren.* Coriandre.—*Ital.* Coriandro; Curiandolo.—*Span.* Cilantro. *Port.* Coentro.—*Ger.* Koriander; Schwindelkörner.—*Dut.* and *Dan.* Coriander.—*Swed.* Koriander.—*Arab.* Kezereh.—*Pers.* Kishneez.—*Tam.* Cottamillie.

FIGURES of Coriandrum sativum in Hayne, vii. 13. Nees von E. 286. Steph. and Ch. ii. 94. Engl. Bot. 67.

THE modern CORIANDER was the Κορίαννον of the Greek physicians.

The plant is an annual,—native in Tartary, the Levant, and southern Europe, and now growing in wild situations in Britain. It belongs to the Natural family *Umbelliferæ*, and to Linnæus's class and order *Pentandria Digynia*. The double cohering fruit, common to the species of the family, constitutes in this plant a firmly united globular body, about the size of white pepper, in which the division of the two segments is not easily seen, but which may be divided into two concavo-convex seeds, like other umbelliferous fruits. Coriander when ripe and dry has a more agreeable aromatic odour and taste than any of the other umbelliferæ; but in the green state the fruit has a disagreeable odour like that of bugs, whence is derived its original name in the Greek language (κόρις, a bug). It contains in a thousand parts 60 of stearine, 70 elain, 40 extractive matter, 75 azotiferous extract, and 4.7 volatile oil (Trommsdorff); the last of which principles is the source of its aroma and activity.

Coriander, owing to its agreeable flavour, is a good deal employed by the confectioner. In medicine it is chiefly used for covering the taste and correcting the nauseating and griping tendency of various other drugs. By some it has been thought the best of all aromatics for correcting the tendency of senna to cause tormina. Accordingly it forms a part of various officinal preparations of senna, such as *Infusum sennæ cum tamarindis*, D.; *Tinctura sennæ composita*, E.; *Electuarium* or *Confectio sennæ*, E. L.

Its dose is from gr. x. ad. dr. i.

CORNU. See *Calcis Phosphas*.

CREASOTUM, *E. L.* *Creasote* (*Edin.*) *An oxyhydro-carburet, prepared from pyroxylic oil*, (*Lond.*)

Tests, *Edin.* Colourless, and remains so under sunshine; Density 1066: entirely and easily soluble in its own volume of acetic acid: a drop on white filtering paper heated for ten minutes about 212° leaves no translucent stain.

Tests, *Lond.* Oleaginous, colourless, transparent, of a peculiar odour. It boils at 397° and does not freeze at —50°. Soluble in acetic acid.

Mistura Creazoti, E.

Process, *Edin.* Take of
Creasote, and
Acetic acid, of each sixteen minims;
Compound spirit of juniper, and
Syrup, of each one fluidounce;
Water, fourteen fluidounces.
Mix the creasote with the acid, add gradually the water, and lastly the syrup and spirit.

Unguentum Creasoti, E. L.

Process. *Edin. Lond.* Take of
Creasote, a drachm;
Axunge, three (two L.) ounces.
Mix them (*Lond.*)
Melt the axunge, add the creasote, stir them briskly, and continue to do so as the mixture concretes on cooling.

For. Names.—Nearly the same in the different continental languages as in English.

In 1830 Reichenbach discovered in the products of the destructive distillation of wood a variety of singular compounds of hydrogen, carbon and oxygen, to which he gave the names of paraffin, eupion, pittacal, picamar, capnomor and creasote. The last of them has alone been put to any use, and has quickly become an important article of the Materia Medica.

Chemical History.—Creasote is so named (κρεας, σωζω) from its extraordinary power of preserving animal matters from decay,—a power which it possesses in a greater degree than any other known substance. It exists, but in a state of great impurity, in wood-smoke, pyroligneous acid, wood-tar, and other products of the destructive distillation of vegetables, as well as in the tar of pit-coal, and in peat-tar. Its most abundant source is the tar or pyroligneous acid obtained from the wood of the birch. In this neighbourhood it is now obtained in large quantity and of fine quality from Archangel tar. Some tars yield nearly one per cent (Lemère).

The processes which have been hitherto made public for pre-

paring it are for the most part complex; but I have reason to believe that they have been much simplified by manufacturers in this country. The general mode of procedure is this. Tar is distilled until paraffine begins to come over in white vapours. The heaviest and consequently lowest stratum of the distilled liquid is agitated with carbonate of potash to neutralize its acid. The supernatant oily fluid is then distilled, and the first portions rejected. The oily matter which follows, on being agitated with weak phosphoric acid to remove ammonia, washed with water to remove excess of acid, and redistilled from diluted phosphoric acid, consists chiefly of eupion and creasote. Agitation with solution of potash dissolves the latter and disengages the former, which floats like an oil. The potash solution becomes brown on exposure to the air and is then decomposed with diluted sulphuric acid; upon which a fresh distillation produces a creasote of considerable purity. It still however tends to become brown when kept; and so long as it exhibits this defect it must be alternately dissolved in solution of potash, and disengaged by sulphuric acid, and finally redistilled until it remains colourless in the sunshine (Ure).——The following simple process has been proposed lately. Distil tar into a cylindrical vessel half full of water. Pour off the watery liquid at the top; add to the heavier liquid at the bottom sulphuric acid diluted with half its weight of water; heat the mixture till it boils; expose the supernatant creasote for three days to the air, stirring it frequently; and distil the product thrice for thorough purification (Gozzi).

Creasote is a colourless, mobile fluid, like an essential oil, of an overpowering, penetrating odour like that of wood-smoke or smoked hams, and of an acrid burning taste. It has a greasy feel, and corrugates and corrodes the cuticle. When pure it is not altered by exposure to light; but it often contains a colouring matter, which after a time renders it brown. I have a specimen of the manufacture of Mr Astley in this vicinity which was exposed for several weeks to full sunshine, and for several years afterwards, continued colourless. Its density is erroneously given in every work I have consulted except the new Edinburgh Pharmacopœia. Instead of being 1037, as originally stated by Reichenbach, I have never found it lower than 1065 or higher than 1067. That of Mr Astley, which is made with extreme care and on a large scale, is 1066, that of a specimen said to have been manufactured in London was 1067, that of some recently manufactured by Reichenbach himself 1065.5. This fact is of consequence in reference to its adulterations. Heat occasions an extraordinary augmentation of its volume, amounting to no less than a sixth between the temperature of 70° and that of 397°, at which it begins to boil. Its boiling temperature being little short of that at which it undergoes decomposition, great care is necessary in distilling it. It unites with a tenth of its weight of water, forming a hydrate. On the other hand, water dissolves a four hundredth part of creasote, and

acquires a peculiar acrid taste, and likewise a powerful smoky odour, perceptible when the solution is diluted till the creasote forms only a ten-thousandth of it. The strong watery solution is a complete preservative against decay in animal substances, insomuch that immersion in it for an hour will prevent meat from putrefying even in summer, and enables it to dry up unchanged when afterwards exposed to the air. Strong sulphuric and nitric acids decompose creasote. Acetic acid dissolves it in all proportions. The alkalis also dissolve it and unite with it. It is likewise easily soluble in alcohol, rectified spirit, ether, volatile oils, and fixed oils. It dissolves the acetates, and reduces the nitrate of silver. It powerfully coagulates albumen. The only analysis yet executed is not implicitly confided in. But according to the experiments already made it is a compound of fourteen equivalents of carbon, seven of hydrogen, and two of oxygen or $C^{14}H^7O^2$ (Ettling).

Adulterations.—It is subject to various adulterations, namely with eupion, picamar, capnomor, and brown colouring matter, owing to faulty preparation, and with fixed and volatile oils fraudulently mixed with it. The testing formula of the London College will detect but a few of these impurities, and is intended, I presume, only for distinguishing the substance. The formula of the Edinburgh College will detect all the adulterations and impurities at present met with. Fixed and volatile oils, eupion and capnomor lower materially its density. These are all separated by strong acetic acid, and float upon the surface of the creasote solution. Fixed oil may be also known by a stain being left on paper from which a drop of the suspected fluid has been made to evaporate at a vapour-bath temperature. Five per cent of this impurity may thus be easily detected. Brown colouring matter and picamar on the contrary tend to raise somewhat the density of creasote. The former is discovered by exposure to the sun's rays quickly occasioning a brown discoloration. Picamar, like eupion, capnomor, and the oils, is separated by acetic acid, as it is insoluble in that reagent.

Actions and Uses.—The researches of Miguet, Corneliani, and Dr Cormack, upon the physiological effects of creasote, prove that it is an irritant, styptic, narcotic, sedative, anodyne, antiseptic, and possibly also a diuretic.

In large doses it is a narcotico-acrid poison. Its irritant action, when it is taken internally in large doses, seems to be veiled or overwhelmed by its narcotic operation; for the leading symptoms of poisoning with it are giddiness, obscurity of vision, depressed action of the heart, convulsions, and coma. Thirty drops will kill a small animal such as a rabbit in a few minutes. When introduced into a vein it occasions instant death by paralyzing the heart. It is equally fatal to vegetable life. It is absorbed in the course of its action; for the urine and breath exhale its peculiar odour for a

long time after it is taken. In the human subject its poisonous action has been sometimes manifested by nausea, vomiting, headache, giddiness, and heat of the tongue, throat, and gullet when doses of five, ten, or twenty drops have been inconsiderately given for medicinal purposes.

Creasote is a powerful styptic, and a topical stimulant of the capillary circulation. As a styptic it has been found effectual in arresting hemorrhage. As an astringent and stimulant together it has been found very serviceable in imparting a healthy action to indolent constitutional ulcers and those which succeed burns, — mitigating inflammation when applied to recent burns, — arresting caries of the bones,—and retarding, as some have thought, the progress of cancer and other malignant ulcerations. Others have used it successfully for the same properties in conjunctival ophthalmia and gonorrhœa. And to the same actions must be referred its undoubted salutary influence as a local application in lepra, psoriasis, and some other scaly disorders. * For this last purpose I have used it often, and with evident advantage. Its forms for the several external uses now mentioned are that of solution and that of ointment. A weak watery solution is probably the best form as a collyrium or gonorrhœal injection; and either the same form, or that of ointment made with from twenty to forty drops for every ounce of axunge, answers well for ulcers, burns, caries, and the like. For cutaneous diseases the ointment is the most convenient shape.

As a topical remedy creasote also possesses unequivocal anodyne and sedative virtues over the nervous system. The best illustration of this is its power of allaying the pain of toothache. It is now acknowledged to be the most efficacious of all local remedies for this purpose, where the affection depends on destruction of the tooth and exposure of the nerve; and according to my observation it never fails in that variety of toothache, provided the hollow in the tooth be properly prepared for it by cleaning out the accumulated sordes. Creasote, used in this way does not occasion any temporary increase of pain, and it does not injure the tooth; but it excites severe burning pain if allowed to come in contact with the tongue or cheek. Unlike other anodynes, creasote often cures toothache radically, and it seldom fails to remove it for a great length of time. For the present purpose it must be used in the concentrated shape, one or two drops being introduced into the hollow of the tooth on a little raw cotton or bit of fine sponge. Creasote has also been recommended by some as a topical anodyne in cases of painful ulceration,—for example, in the ulcerative stage of cancer and noli me tangere.

As an internal agent creasote in medicinal doses sometimes exhibits irritant effects; but its most frequent and remarkable action is that of an anodyne and sedative. It has been already observed that the larger medicinal doses are apt to excite sickness and pain

in the throat; and in some instances even a tendency to diarrhœa or dysentery is supposed to have been observed. Its ordinary action however is to allay pain and muscular irritability. It has been found serviceable in some cases of neuralgia of the face, when administered internally; and relief has also been obtained from it in painful malignant ulceration of the stomach. Its most striking effects however as an internal sedative are shown in the arrestment of vomiting; a property which seems to have been first observed by Dr Elliotson. It allays vomiting from functional disorder of the stomach, or nervous irritability of that organ; and even in that which depends on organic disease in the stomach itself it is not unfrequently of great temporary benefit. It has been found by accoucheurs a valuable remedy for the chronic vomiting of pregnancy. Others have observed it to be useful in the most obstinate of all kinds of vomiting,—sea-sickness.

It is impossible to speak with much confidence of the advantage of creasote internally in the other diseases for which it has been administered. Experience has not confirmed the sanguine hopes drawn from the statements of Berndt and Elliotson, that it would prove a remedy for saccharine diabetes. In two cases at one time under my observation the flow of urine increased. Nor can much be said of its efficacy in cholera, hæmoptysis, phthisis, menorrhagia, or bronchitis; for all of which diseases it has been recommended. It is worthy of notice however, that an old German nostrum for chronic diseases of the chest, called Aqua Binelli, seems to contain creasote for its only active ingredient.

To these remarks on its medicinal uses may be added a few observations regarding its antiseptic properties over dead animal matter. It has been remarked above that no substance at present known equals creasote in its power of preventing the decay of animal matter. Immersion in creasote-water will prevent flesh from decaying even in warm, moist air; and if a strong solution, made with the aid of acetic acid be injected into the bloodvessels of a body, the preservation would appear to be as complete as by the Egyptian method of embalming. Its powerful diffusive odour is the only objection to its use for preserving bodies for dissection. It may be used instead of wood-smoke or empyreumatic pyroligneous acid for curing hams, sausages, tongues and the like, and is evidently the aromatic and preservative principle of these articles when cured by the ordinary process of smoking. That it is the most important ingredient of the materials used in the Egyptian art of embalming, and that it may be efficaciously employed for the purpose, has been rendered probable by the researches of Dr Cormack.

The dose of creasote for internal use is one or two drops, and onwards to five at most. A convenient form for general use is the Edinburgh *Mistura creasoti;* the strength of which may be increased if necessary. An emulsion, which is a less eligible form, may be made with yolk of egg and syrup. A lotion may be made

by dissolving from five to ten drops in half a pint of water. The ointment of the London College contains 30 grains, that of Edinburgh 40 per ounce.

CRETA, *E. L. D.* See *Calcis Carbonas.*

CROCUS, *E. L. D.* *The Stigmata of Crocus sativus, Allioni, Fl. Ped.—DC. Flore Française.* *Saffron.*

SYRUPUS CROCI, E. L.

PROCESS, *Edin. Lond.* Take of
Saffron, ten drachms;
Boiling-water, a pint;
Sugar, three pounds.
Infuse the saffron in the water for twelve hours in a lightly covered vessel; strain the liquid and add the sugar.

TINCTURA CROCI, E.

PROCESS, *Edin.* Take of
Saffron, chopped fine, two ounces;
Proof-spirit, two pints.
This tincture is prepared like tincture of cinchona, either by percolation or by digestion, the former method being the more convenient and expeditious.

FOR. NAMES.—*Fren.* Safran.—*Ital.* Zafferano.—*Span.* Azafran.—*Port.* Açafrão.—*Ger.* and *Dan.* Safran.—*Dut.* Saffraan.—*Swed.* Saffran.—*Russ.* Schafran.—*Arab.* Zafran.—*Pers.* Abeer.—*Tam.* Khoongoomapoo.

FIGURES of Crocus sativus in Nees von E. 58.—Hayne, vi. 25.—Engl. Bot. 343.—Steph. and Ch. iii 104. Roque, 37.

SAFFRON is the Κρόκον of the Greek physicians, among whom it was in frequent use.

Natural History.—It is referred by the three British Pharmacopœias to a single species, *Crocus sativus;* but it is also produced by *C. autumnalis*, and in Sicily by *C. odorus.* All these plants belong to the Linnæan class and order *Triandria Monogynia*, and to the Natural family *Iridaceæ.* The *C. sativus*, whence saffron is chiefly obtained, grows naturally in Asia Minor and Eastern Europe; but it is also extensively cultivated in Britain, as well as in most continental countries; and in Britain it has strayed into wild localities. It produces in September and October beautiful bluish flowers, which present a single style terminating in three elongated wedge-shaped stigmata, notched at the extremities, and of a fine deep orange colour. These stigmata constitute the officinal part of the plant, the Saffron of commerce. Saffron is extensively cultivated in England, France, Spain, Sicily, &c. An acre yields about five pounds of dry saffron; and one pound requires 61,440 flowers (Clamor-Marquart). There are two kinds of it met with in commerce, called Hay and Cake Saffron. The former, which is most esteemed, consists simply of the loose stigmata entangled together, and retaining their original deep orange colour. The latter, or Cake saffron, forms flexible cakes about half a line in thickness, and of a dirty brownish-orange tint, which are made by beating the stigmata together before they are quite dry. Saffron has a powerful, aromatic, somewhat stupefying odour, and a bitterish,

balsamic, rather acrid taste. The taste and odour diminish with keeping unless it be carefully preserved in close vessels. It tinges the saliva bright yellow when chewed, and renders the fingers orange if squeezed between them. It yields its colouring and odoriferous parts readily both to water and spirit; which are accordingly used as officinal menstrua, the former for the *Syrupus*, the latter for the *Tinctura Croci.* It consists according to Vogel and Bouillon-Lagrange of 7.5 per cent volatile oil, 6.5 gum, a little wax and albumen, some lignin and moisture, and 65 of a yellow colouring matter which has been termed Polychroïte. The volatile oil is probably its active ingredient. The colouring principle when pure is tasteless and without odour, easily soluble in rectified spirit, sparingly so in water, moderately so in ether and the fixed and volatile oils, soluble also in alkalis, but not in acids. The colour is destroyed by the sun's rays.

Adulterations.—Saffron is much subject to adulteration; and the impurities with which it is said to be mixed are safflower, shreds of marigold flowers or pomegranate blossoms, and muscular fibre. The last adulteration is best known by burning the suspected article, which emits an odour of burning horn; the admixture of flowers may be readily discovered by soaking the threads in water and examining their structure, which is quite different from that of the stigmata described above. Saffron which has been exhausted by water or spirit is sometimes substituted for the genuine drug. This is known by its not staining the skin yellow when rubbed between the finger and thumb.

Actions and Uses.—The actions of this substance are obscure. It was long thought, and is still believed by many continental physicians, to be a narcotic in large doses, and in small doses a stimulant, calmative, antispasmodic, and emmenagogue. In this country its emmenagogue virtues have been generally admitted, although by no means well established. But upon the whole it is little used now in British practice, except for improving the colour or modifying the taste and odour of other drugs. Abroad it still in some measure retains its reputation as a remedy for suppressed menstruation, suppression of the lochial discharge, and some spasmodic diseases, such as asthma and hooping-cough. In British pharmacy it is used for imparting colour to the compound tinctures of aloes, cinchona, and rhubarb, the compound decoction of aloes, and the aromatic confection; and it also forms a part of the *Pilula styracis*, and *Pilula aloes et myrrhæ.* It forms a material proportion of a continental tincture of opium, also long used in this country under the name of Sydenham's laudanum, although now forgotten. In this preparation, the *Tinctura opii crocata* of German Pharmacopœias, the saffron is held to concur with the opium in its calmative and antispasmodic virtues, and also to tend to correct the subsequent and idiosyncratic effects of that drug.

The doses of saffron and its preparations are,—*Crocus*, gr xii.

ad scr. ii.—*Croci syrupus*, E. L. dr. i. ad dr. ii.—*Croci tinctura*, E. fl. dr. i. ad fl. dr. ii.

CROTONIS OLEUM, *E.* TIGLII OLEUM, *L.* CROTONIS TIGLII OLEUM, *D.* *Expressed oil of the seeds of Croton Tiglium, W. Spr. Croton-oil.*

TESTS, *Edin.* When agitated with its own volume of pure alcohol and gently heated, it separates on standing, without having undergone any apparent diminution.

FOR. NAMES.—*Fren.* Huile de croton.—*Ital.* Olio di croton.—*Ger.* Crotonoel.—*Tam.* Nervalum unnay.

FIGURES of Croton Tiglium in Nees von E. 138.—Hortus Malabar, ii. 33. Rumph. Amboyn. iv. 98.—Steph. and Ch. i. 4.—Roque, 170.

THE properties of CROTON-OIL seem to have been known immemorially in eastern countries. The wood of the plant which produces it was used at an early period in Europe, and was termed *Lignum Molluccense* or *Lignum Pavana.* The seeds were first introduced into European practice in the time of Rumphius about two centuries ago under the name of *Grana Tiglia* or *Tigalia.* But they were little used at that period, and seem to have been eventually lost sight of altogether until they were mentioned in 1813 among Indian drugs by Sir Whitelaw Ainslie in his Materia Medica of Hindostan. Since then the oil obtained from the seeds has become a common purgative in Britain.

Natural History.—Croton-oil is obtained chiefly from the *Croton Tiglium*, but also in part from an allied species, *C. Pavana* (Hamilton). *C. Tiglium*, the most important species, grows naturally in Hindostan, Ceylon, the Molucca Isles, and other parts of eastern Asia. It is a shrub of moderate size, which produces a somewhat ovate and triangular fruit, rather bigger than a hazel-nut. The seeds, three in number, are about the size of a pea, but ovoid in form, reddish-brown when recent, grayish-brown when old, or more seldom brownish-black. They consist of a thin, brittle, ligneous shell, a delicate, white, membranous integument, and an oleaginous kernel composed of a pale yellowish-white albumen, and a beautiful embryo with large, leafy cotyledons. Croton-oil is obtained from the kernels by removing the shell, bruising them into a pulp and subjecting the pulp to strong pressure. About 50 per cent of oil may be thus obtained; and ten per cent more may be removed by the solvent action of sulphuric ether, which is afterwards expelled by a gentle heat.

Chemical History.—Croton-seeds have been analysed by Dr Nimmo, by Brandes, and by Pelletier and Caventou. They contain coagulated and soluble albumen, gum, fixed oil, and a peculiar, acrid, volatile acid, besides other less important principles. The greater part of the volatile acid passes out with the fixed oil separated either by expression or by ether. The croton-oil of commerce is partly imported from India, partly expressed in London from the seeds. The best oil has a very pale amber colour and

considerable unctuous thickness, like castor-oil. It is without odour, but has a peculiar acrid taste, felt most strongly in the back of the palate and throat. It is very soluble in sulphuric ether, the volatile oils, and the fixed oils. Absolute alcohol scarcely affects it when cold, but at a boiling heat completely dissolves its own bulk of the oil, of which however 96 per cent is deposited immediately by cooling and rest [Maclagan]. It consists of a pure, bland, fixed oil, and the same acid which is found in the seeds. This principle, which has been named Crotonic acid, may be obtained by saponifying the oil with potash, decomposing the soap with tartaric acid, distilling the filtered solution, neutralizing the acid product with barytic water, evaporating the solution to dryness, decomposing the barytic salt with strong phosphoric acid, and repeating the distillation. The acid thus obtained is crystalline in the cold, highly volatile, of an acrid taste, and intensely irritating to the nostrils. It neutralizes bases; but its properties have not been particularly examined. It is in all probability the source of the activity of Croton-oil as an irritant and purgative.

Adulterations.—Croton-oil is supposed to be much subject to adulteration, and it is generally stated to be less active now than that used at the time of its first introduction into British medicine. This is not consistent with my own observation. It is sometimes of a reddish-brown colour, which is owing to the seeds having been kept too long and become musty,—to which they are exceedingly prone. It is not easily adulterated with the common fixed oils, with the exception of castor-oil, because this is the only common oil which possesses sufficient thickness to impart due unctuosity. Castor-oil may be detected by the test mentioned in the Edinburgh Pharmacopœia: Absolute alcohol shaken with the adulterated oil will dissolve out the impurity, and thus lessen its volume; but no visible diminution is produced on pure croton-oil. Five per cent of castor-oil may be thus detected; but the application of heat as recommended by the College is unnecessary.—Some have thought that the sickness and vomiting often occasioned by croton-oil are owing to certain faulty methods of preparing it; and it has been imagined that these effects may be prevented by removing the embryo before expressing the oil, or according to some by removing the perispermal membrane. Such notions however are all erroneous. Nausea and vomiting are constitutional incidents, unconnected with differences in the drug itself.—On the continent a counterfeit article, prepared sometimes with Canada balsam and jalap resin, sometimes with castor-oil and euphorbium, is occasionally substituted for croton-oil (Landsberg). The former is easily known by its comparatively sparing solubility in ether, the latter by being easily soluble in alcohol.

Actions and Uses.—Croton-oil is a powerful irritant and cathartic. In large doses it is a dangerous poison. Forty croton-seeds will kill a horse in seven hours; and thirty drops of the oil have

killed a dog (Landsberg). The half of a seed, about a grain in weight, will cause brisk watery purging in man; and I have known four grains of the oil occasion alarming hypercatharsis. It also acts as an irritant upon the skin, producing erythematic redness, intense burning, and an eruption of minute vesicles. When administered internally in medicinal doses, it acts with great certainty as a hydragogue cathartic.

Its special applications in the practice of the present day are as an external counter-irritant, and as a purgative. For the former purpose it is rubbed upon the skin, dissolved in two or three parts of camphor liniment, or oil of turpentine. As a purgative it is used chiefly when the bowels are very torpid, or in comatose diseases where it is difficult to administer other brisk cathartics, or in dropsy as a hydragogue. It is distinguished from other powerful purgatives by occasioning much borborygmus, by its action commencing speedily and ending soon, and by the cathartic effect, however exhausting at the time, being followed by little debility. It has been particularly recommended as a superior purgative in tic douloureux as well as other forms of neuralgia, when connected with disorder in the stomach and bowels; and the disease seems to be sometimes entirely removed by it. Some have found it so useful as to imagine it has a specific action in tic. But there is no foundation for this doctrine.

Croton-oil commonly excites a disagreeable acrid sensation in the throat, with a constant tendency to hawk; and it also causes at times troublesome sickness and vomiting. The former effect is best prevented by administering it in the form of pill, well covered with starch or lycopodium. The latter inconvenience is not so easily prevented; but it ceases with the purgative action of the drug. When croton-oil is administered in apoplexy or other comatose disorders, it is best given on a bit of sugar, which is introduced into the throat, or simply placed on the back of the tongue. For other purposes a more convenient method is to add one or two drops to any of the common purgative pill masses, such as the colocynth or aloetic pill. In obstinate constipation two drops with ten grains of the colocynth pill will generally prove sufficient. I have repeatedly however known this dose given thrice at short intervals before moving the "dura ilia" of some hospital patients. All the pharmaceutic formulæ for giving it in the form of emulsion, tincture, or soap are objectionable; because it thus exerts its disagreeable action on the throat. It may be conveniently used for strengthening the action of castor-oil in the dose of one or two drops.

The dose of croton-oil is from gtt. i. ad gtt. vi.

CUBEBAE, *E.* PIPER CUBEBA, *L. D.* *Fruit of Piper Cubeba (L. Suppl.—W. Spr.)* *Cubebs.*

OLEUM CUBEBAE, E.

PROCESS, *Edin.* To be prepared from Cubebs according to the general directions for preparing volatile oils. See *Introduction.*

TINCTURA CUBEBAE, L. D.

PROCESS, *Lond. Dub.* Take of Cubeb-pepper, bruised, 5 ounces (4, D.) Proof-spirit, two pints (pounds D.) Macerate for fourteen days and strain.

FOR. NAMES.—*Fren.* Cubèbes; Poivre à queue.—*Ital.* Pepe cubeba.—*Span.* Cubebas.—*Port.* Cobebas.—*Ger.* Kubeben-pfeffer.—*Dut.* Koebeben.—*Swed.* Kobeben.—*Dan.* Cubeber.—*Russ.* Perets kubeba.—*Arab.* Kebabeh.—*Tam.* Val mellaghoo.—*Hind.* Cubab chinie.

FIGURES of Piper Cubeba in Nees von E. 22.—Steph. and Ch. iv. 175.

THIS remedy, originally derived from Eastern Asia, was used at an early period in Europe, under the name of *Cubeba* or *Piper caudatum;* but it had been abandoned in the practice of this and other European countries, and was resumed only after the beginning of the present century, at the recommendation of British practitioners in India, as a familiar remedy there for gonorrhœa.

Natural History.—Cubebs are the fruit of *Piper Cubeba*, or *Cubeba officinalis* of Miguel, a small climber inhabiting Java, Prince of Wales' Island, and other isles in the Indian ocean. It belongs to the Natural family *Urticeæ* of Decandolle, and *Piperaceæ* of Lindley, and to Linnæus's class and order *Diandria Trigynia.* It produces clusters of small berries scarcely so large as white pepper, which are the officinal part of the plant. They are generally imported into Europe with their peduncles attached. They are nearly globular, rough, grayish, of a rather agreeable aromatic odour and of a hot, bitterish, somewhat camphoraceous taste. Their composition is complex, the most important ingredients being volatile oil, a balsamic resin, and a peculiar principle named *Cubebin* (Monheim). The volatile oil, which is probably the active principle, may be separated by distillation with water, to the amount of seven per cent according to my own experiments. It is colourless, thick, and of the peculiar odour and aromatic taste possessed by the berries themselves. Cubebin, first detached by Casola, is a neutral substance of a sweetish acrid taste, greenish, concrete at 5° F, of the consistence of honey at 50°, fluid at 68°, and volatile about 90°.

Actions and Uses.—Cubeb-pepper is in action a stimulant, stomachic, and carminative, and possesses the property of arresting excessive mucous discharges, especially from the urethra. It is chiefly for the last purpose that it has been hitherto employed in European practice; but it is an esteemed carminative stomachic in the East. It is nearly, some think entirely, on a par with copaiva as a remedy for gonorrhœa; and its employment is governed by precisely the same circumstances. The reader is therefore referred to the article *Copaiba* for the particulars. It excites some exhilaration; doses too large are apt to occasion nausea or vomiting; and I have known it bring on, like copaiva, an attack of ephemeral synocha, attended with prompt and permanent cessation of the gonorrhœal discharge. Some doubt its virtues. I have generally found it efficacious. Its use has been extended to fluor albus, in which I have sometimes found it successful,—and to catarrh of the

urinary bladder, in which however it has been thought by some to aggravate the disease if given in large doses. It may be administered for gonorrhœa in the form of powder along with water or milk, or made into a paste with half its weight of copaiba. The tincture may be used as a carminative. The oil has appeared to me at least equal to the pepper itself in gonorrhœa.

The doses of its preparations are *Cubebæ*, E. *Piper Cubeba*, L. D. dr. ss. ad dr. iii. thrice daily.—*Tinctura cubebæ*, L. D. fl. dr. ii. —*Oleum cubebæ*, E. min. x. ad fl. dr. ss.

CUCUMIS COLOCYNTHIS, *D.* See *Colocynthis.*

CUMINUM CYMINUM, *E. L.* *Fruit of Cuminum Cyminum. L. W. Spr. DC.—Cumin.*

For. Names.—*Fren.* Cumin.—*Ital.* Comino.—*Span.* Comino.—*Port.* Cominho.—*Ger.* Römischer Kümmel.—*Dut.* Komijn.—*Swed.* Spyskummin.—*Arab.* Kemun.—*Pers.* Zerch.—*Tam.* Siragum.

Figures of Cuminum Cyminum in Nees von E. 288.—Hayne, vii. 11.

Cumin is one of the umbelliferous aromatics which have been known from the most remote periods of medicine, being the Κυμίνον of the Greek physicians.

The plant, which grows naturally in Greece and Egypt, belongs to Linnæus's class and order *Pentandria Digynia*, and to the Natural family *Umbelliferæ.* The fruit is ovate or fusiform, and consists like other umbelliferous fruits of two adhering concavo-convex fruits, each of which presents seven ridges. It has a strong, rather unpleasant odour, and a corresponding aromatic taste, somewhat like that of caraway, but hotter and not so agreeable. It yields a distilled water and a distilled spirit in the usual way. It contains a volatile oil which may be separated by distillation with water. This oil is yellowish, thin, 945 in density, and possesses the odour and taste of cumin.

Like other umbelliferous aromatics, cumin is a stimulant and carminative. It is put to little use in this country; and, considering how many aromatics belonging to the same family are in the Pharmacopœias, this one might be dispensed with. It is not now contained in any officinal preparation of the British Colleges.

Its dose is from gr. x. ad gr. xx.

CUPRI ACETAS, *D.* *Crystallized Acetate of Copper.*

CUPRI SUBACETAS, *D.* AERUGO, *E. L.* *Diacetate of Copper.*

Tests, *Edin.* It is dissolved in a great measure by muriatic acid, not above five per cent of impurity being left.

Tests, *Lond.* Almost entirely soluble in ammonia, and in diluted sulphuric acid with the aid of heat: partially soluble in water.

CUPRI SUBACETAS PRÆPARATUM, D.

PROCESS, *Dub.* Triturate subacetate of copper, and separate its finest particles in the same way as for Prepared chalk. See *Creta.*

UNGUENTUM AERUGINIS, E. UNG. SUBACETATIS CUPRI, D.

PROCESS, Take of
Resinous ointment, fifteen (twelve, D.) ounces;
Verdigris in fine powder, one (half an, D.) ounce;
(Olive Oil, an ounce, D.)

Melt the ointment, sprinkle into it the verdigris (add the verdigris previously triturated with the oil, D.), and stir briskly, as the mixture concretes.

LINIMENTUM AERUGINIS, L.

PROCESS, *Lond.* Take of
Powder of verdigris, an ounce;
Vinegar, seven fluidounces;
Honey, fourteen fluidounces.

Dissolve the verdigris in the vinegar, strain through cloth, add the honey, and boil down the whole to the due consistence.

FOR. NAMES. *Acetas cupri.*—*Fren.* Verdet crystallisé.—*Ital.* Acetato neutro di rame; Verde eterno.—*Ger.* Essigsaures kupferoxyd; Destillirter grünspan. —*Russ.* Uksusnokislaia okis medi.
Aerugo. *Fren.* Verdet; Vert de gris.—*Ital.* Verde rame.—*Span.* Cardenillo. *Ger.* Grünspan.—*Dut.* Koper groen; Spaansch groen.—*Swed.* Spanskgröna. *Dan.* Spanskgront.—*Russ.* Jar medianka.—*Arab.* Zunjar.—*Pers.* Zungar.— *Tam.* Vungalap-patchei.

IT is well ascertained that the *Ærugo* of the Romans comprehended both the carbonate or rust of copper, and the basic acetate commonly called VERDIGRIS, and that the latter kind of it was prepared by a process similar to what is still followed in the wine countries of Europe.

Chemical History.—Verdigris is obtained by exposing copper to the action of acetic acid under the access of atmospheric air. In the south of France the acid is derived from the acetous fermentation of the husks of grapes, which are laid in alternate layers with copper plates; in other parts, vinegar is sprinkled over the copper; and in this country the usual practice is understood to be to interpose between the metallic plates cloths steeped in pyroligneous acid. The product differs somewhat according to the process,—that obtained by the French method inclining more to a blue tint, while that got by the British mode tends more to green. But in all of the processes the copper undergoes oxidation by means of the oxygen contained in the water, or abstracted through means of the water from the atmosphere; and this oxide at the same time unites with the acetic acid.

Verdigris is sold either in loosely aggregated lumps, or in the form of powder. In both states, as seen in this country, it has a pale bluish-green colour, a disagreeable acetous odour in consequence of the powder from its tenuity being carried into the nostrils, and a nauseous styptic coppery taste. It preserves its colour well unless exposed to sulphuretted-hydrogen, which speedily blackens it. When heated, it first parts with a portion of water at a low temperature. As the heat increases, acetic acid is disengaged; but a portion of its acid at the same time is decomposed, the oxide of copper is reduced, and thus, at a temperature much below redness,

metallic copper is formed, and communicates to the powder its peculiar brown colour. Water acts on verdigris. The action which takes place is not one of solution merely, but of chemical decomposition also, as will be presently explained. Diluted sulphuric acid dissolves it entirely, with the exception of such impurities as it may contain; and a blue solution is produced from which sulphate of copper may be crystallized. Muriatic acid too dissolves all but impurities, and forms a fine green solution. Solution of ammonia also promptly dissolves all but its impurities, and produces an intense violet blue liquid. The effects of heat and of ammonia are the most characteristic properties of this substance.

Although the London and Edinburgh Colleges have considered the verdigris of commerce to be a definite chemical compound, it is not uniform in composition, but seems a variable mixture of several basic acetates, of which Berzelius admits no fewer than four. The researches of Mr R. Phillips however have shown that the verdigris usually met with in this country is essentially a hydrated diacetate of copper, consisting of two equivalents of base, one equivalent of acid, and six equivalents of water ($\bar{A} + 2\,CuO + 6\,HO$). The effect of water on this compound is to occasion a new arrangement of the acetic acid and oxide of copper, in consequence of which a neutral acetate is obtained in a state of solution, while an insoluble compound is left, containing a larger proportion of base than the diacetate. If heat be at the same time used, the decomposition is more complete, and a brown powder is left, which according to some is oxide of copper, and according to others a compound containing about two and a half per cent of acetic acid.

The salt dissolved by the water is the neutral acetate, which by evaporation and cooling is obtained in fine rhomboidal or rhombic-octaëdral crystals of a beautiful bluish-green colour. This is the *Cupri acetas* of the Dublin Pharmacopœia. It is an efflorescent salt, soluble in five parts of boiling water, and somewhat soluble also in alcohol. When heated in the open air it takes fire and burns with a beautiful green flame; and when heated in close vessels it gives off water and acetic acid. It is composed of an equivalent of acid, of base, and of water ($\bar{A}+CuO+HO$). At one time concentrated acetic acid was obtained by decomposing this salt in a distilling apparatus; but more convenient processes have gradually displaced that method in pharmacy.

Adulterations.—Neither verdigris nor the neutral acetate of copper is particularly subject to adulteration. The requisite purity of the former is best ascertained by the effects of diluted sulphuric acid or of ammonia, as mentioned by the London College,—or by the solvent action of muriatic acid, as directed in the Edinburgh Pharmacopœia. I have never found in good verdigris more than five per cent insoluble in muriatic acid; and the impurity is chiefly copper and earthy matters.

Actions and Uses.—Both acetates of copper possess a powerful

irritant action, in consequence of which they are active poisons. A few grains may occasion death. White of egg or some other albuminous fluid is the best antidote. As irritants they possess emetic properties; and indeed at one time the neutral acetate was employed on this account in cases of narcotic poisoning. It is liable however to the same objections for that purpose as the sulphate of copper, and is now abandoned. Verdigris has been given internally in some diseases, and in particular was supposed useful in this way as a remedy for cancer. But it is now confined in its applications to external diseases, more especially indolent ulcers, and chronic eruptions such as ringworm of the scalp. In the form of ointment I have known it serviceable in ringworm. It is also of use in ophthalmia tarsi.

There are but two preparations of it, both for external use, the *Unguentum æruginis*, E. or *Unguentum subacetatis cupri*, D. and the *Linimentum æruginis*, L.

CUPRUM AMMONIATUM, *E. D.* CUPRI AMMONIO-SULPHAS, *L.* *Nature doubtful.*

TESTS, *Lond.* It is converted by heat into oxide of copper, giving off ammonia. Its solution changes the colour of litmus, and becomes green on the addition of arsenious acid.

PROCESS, *Edin. Lond. Dub.* Take of Sulphate of copper, one ounce; Carbonate (sesquicarbonate, L. subcarbonate, D.) of ammonia, half an ounce.

Triturate them together (in an earthenware mortar, D.) till the effervescence entirely ceases; wrap the mass in bibulous paper and dry it without heat.

LIQUOR CUPRI AMMONIO-SULPHATIS, L. CUPRI AMMONIATI AQUA, E. D.

PROCESS, *Edin. Lond. Dub.* Take of Ammonio-sulphate of copper (ammoniated copper, E. D.) one drachm; Distilled water, a pint (fourteen fluidounces, D.)

Dissolve the salt in the water and filter.

PILULÆ CUPRI AMMONIATI, E.

PROCESS, *Edin.* Take of Amm. copper in fine powder, one part; Bread-crumb, six parts; Solution of carbonate of ammonia, a sufficiency.

Beat them into a proper mass; and divide it into pills, each containing half a grain of ammoniate of copper.

FOR. NAMES.—*Fren.* Sulphate de cuivre ammoniacal.—*Ger.* Kupfer salmiak; Schwefelsaures kupfer-oxyd-ammoniak.

THIS substance seems to have been known since 1757, when Weissman pointed out one of the processes for making it, though not that now followed (Geiger).

Chemical History.—When sulphate of copper and sesquicarbonate of ammonia are triturated together, brisk effervescence takes place from the disengagement of carbonic acid, while at the same time the mass becomes moist from the separation of a part of the water of the salts, and a crystalline substance is obtained of a beautiful violet colour, which was long known in pharmacy by the convenient name of Ammoniacal copper. Various opinions have been entertained of the nature of the product. Mr Phillips seems to

maintain that it is nothing more than a mixture or compound of carbonate of copper and sulphate of ammonia, with an excess of sesqui-carbonate of ammonia (Transl. of Phar. Lond. 1836). But it is more probably a mixture of the last salt with a double sulphate of ammonia and copper. A regular double salt of this nature, the ammoniacal copper of some continental Pharmacopœias, may be obtained by a different process. This is prepared by dissolving powder of sulphate of copper to saturation in solution of ammonia, and adding rectified spirit; upon which a fine blue crystalline powder is separated. If two volumes of rectified spirit be gently poured over one volume of the solution so as to float on its surface, and the vessel be left at rest for fourteen days, fine blue crystals of considerable size will be obtained. According to Berzelius the substance thus formed is a sulphate of copper and ammonia with water of crystallization, and it is composed of one equivalent of acid, one equivalent of oxide of copper, two equivalents of ammonia, and one equivalent of water ($CuO+2H^3N+SO^3+HO$). It seems reasonable to suppose, from the action which takes place on triturating sulphate of copper and sesquicarbonate of ammonia together, as well as from the crystalline appearance of the product, that the ammoniacal copper of the British Pharmacopœias contains the double salt here described; and there is obviously an excess of sesquicarbonate of ammonia, because the pure double salt has not, like the officinal salt, an ammoniacal odour. There is no ground for the designation now first given to this substance by the London College.

The pure double sulphate of copper and ammonia crystallizes in four-sided prisms of a splendid blue colour. Under exposure to the air it parts with ammonia and falls into a greenish powder. Large crystals, according to Geiger, may be kept exposed for years without change. It is insoluble in rectified spirit. Water dissolves it readily and entirely; but if the solution be much diluted, it is decomposed, and a disulphate of copper falls down insoluble, while a double sulphate remains in solution with an excess of ammonia. The properties of the ammoniacal copper of the Pharmacopœias are essentially the same. It is a violet-blue crystalline powder, exhaling the odour of ammonia, and possessing a strong styptic, metallic, coppery taste. If too much dried or not carefully kept, it parts with some ammonia. When well prepared, it is soluble in a moderate quantity of water, but if ammonia have escaped from it, an insoluble disulphate of copper separates; and the same change takes place even with a well-prepared compound when its solution is much diluted. Decomposition always takes place in making the officinal solutions of the Colleges. The solution precipitates arsenious acid in the form of the green arsenite of copper.

Adulterations.—The adulterations of this substance have not been studied. The tests of the London college are intended to ascertain its nature rather than to detect impurities.

Actions and Uses.—Its actions are essentially the same with those of the next salt, the sulphate of copper. It is an irritant poison, an astringent, an emetic, and a tonic. Externally, in the form of the officinal solution, it has been at different times used as a wash for indolent and constitutional ulcers, and also, when diluted still farther, as a collyrium in chronic ophthalmia, especially for removing specks on the cornea. Internally, it is chiefly used as a tonic. It is the preparation of copper commonly preferred for obtaining the tonic action of this metal; and it has been a good deal employed, like other metallic tonics, in the treatment of epilepsy. I have seen several cases get well under its use, particularly where the disease occurred about the period of puberty or soon after; and I have never witnessed the irritant effects on the stomach complained of by some, though doses of half a grain or a whole grain were given thrice a-day for months together.

Its officinal preparations are: *Cuprum ammoniatum*, E. D. *Cupri ammonio-sulphas*, L. gr. ss. ad gr. i. *Liquor cupri ammonio-sulphatis*, L. *Cupri ammoniati aqua*, E. D. external. *Pilulæ cupri ammoniati*, E. one or two thrice daily.

CUPRI SULPHAS, *E. L. D.* *Sulphate of Copper.*

Tests, *Edin.* Not subject to adulteration.

Tests, *Lond.* Entirely soluble; the precipitate formed in its solution by ammonia is entirely dissolved by an excess of that alkali. It effloresces very slightly into a greenish powder.

For. Names.—*Fren.* Sulfate de cuivre; Vitriol bleu.—*Ital.* Solfato di rame; Vitriolo Turchino.—*Span.* Vitriolo azul.—*Port.* Vitriolo de cobre; Capparosa azul.—*Ger.* Schwefelsaures kupferoxyd; Kupfer-vitriol.—*Dut.* Koper-rood.—*Swed.* Blä witriol.—*Dan.* Blaau vitriol.—*Russ.* Sernokislaia okis medi; Mednoi kuporos.—*Arab.* Zungbar.—*Tam.* Toorishoo.

Sulphate of Copper (Blue Vitriol, Vitriol of Copper) is a natural production, being obtained from the water of some springs issuing from copper mines. It was known to the ancients.

Chemical History.—It is prepared in a variety of ways, sometimes by directly acting on metallic copper with sulphuric acid aided by heat; sometimes by making sulphuret of copper artificially with old copper, roasting the sulphuret till it is oxidated, and lixiviating the sulphate thus formed; sometimes by allowing the native sulphuret of copper to oxidate spontaneously in the air or with the aid of heat, and lixiviating the product as by the last method. As obtained in the first instance by these processes it usually contains some sulphate of iron, which is removed in a great measure by roasting the salt at a moderate heat, so as to peroxidate the oxide of iron and drive off its sulphuric acid,—and then dissolving the sulphate of copper and crystallizing it. When purified in this manner it is quite pure enough for all medicinal and pharmaceutic purposes, although it still generally contains a small proportion of sulphate of iron.

This salt is usually met with in the shops in fragments of large

crystals of a beautiful azure-blue colour. The primitive form of the crystal is an oblique rhombic prism. It is without odour, but it has an intense styptic metallic disagreeable taste. It effloresces slightly in the air, more quickly if the air be dry, and completely at the temperature of 104° and upwards, so as to be changed into a crumbly mass. When heated it first fuses in its water of crystallization, then gradually becomes a white anhydrous powder, and at an elevated temperature slowly parts with its acid, the brown protoxide of copper being left. The crystals are soluble in four parts of temperate water, and in two parts or less of boiling water. The solution is of a fine blue colour, and is precipitated brownish-black by sulphuretted-hydrogen,—bluish-green by caustic potash in small proportion,—azure-blue by the same test in slight excess, —azure-blue by ammonia, which in excess redissolves the precipitate,—and grass-green or apple-green by solution of arsenious acid with the addition of an alkali. The precipitate thrown down by potash in small proportion is a disulphate of copper; that by an excess of alkali is the hydrated oxide. Ammonia in excess forms a deep violet-blue solution of a double salt, the sulphate of copper and ammonia. The arsenical test precipitates the arsenite of copper. Of these reagents ammonia is the most characteristic, and it is exceedingly delicate. The salt is composed of one equivalent of sulphuric acid, one equivalent of oxide of copper, and five equivalents of water ($CuO + SO^3 + 5\ HO$), that is 40.1 acid, 39.6 base, and 45 water. Some erroneously consider it a bisulphate. Professor Graham considers it a hydrated compound of sulphuric acid with two bases, an equivalent of water being one of them ($CuO + HO + SO^3 + 4\ Aq.$)

Adulterations.—The sulphate of copper of the shops in this country is commonly a very pure salt. The only adulteration of any consequence, and a rare one, is sulphate of iron. This may be easily detected by boiling the solution with a little nitric acid so as to peroxidate the iron, and then adding ammonia in excess, which redissolves the blue cupreous precipitate first thrown down, leaving a yellowish flaky powder if there be any ferruginous impregnation.

Actions and Uses.—This salt in its action on the animal body is an irritant, emetic, tonic and astringent. It is a powerful irritant poison; but, besides producing inflammation and irritation where it is applied, it seems also to act remotely, like other preparations of copper, upon the brain, and to occasion death by inducing coma with convulsions. In the dose of six, eight, or twelve grains it is a certain and speedy emetic, not inferior to sulphate of zinc; and it was accordingly much used at one time in cases of narcotic poisoning, and in all other circumstances where prompt evacuation of the stomach was desired. It is now however properly abandoned in favour of the sulphate of zinc; because the latter is much less unsafe as an irritant poison, where the stomach happens to be insensible to the action of emetics, and consequently retains them. Sulphate of copper has been employed as a tonic in epilepsy; but the

ammonical sulphate has been more commonly preferred for that purpose. It has been also thought by some to be useful in croup as a specific. Of late it has been a good deal employed and strongly recommended, especially by various physicians in Dublin, as an astringent in chronic dysentery and diarrhœa; but acetate of lead is at present more generally preferred to other mineral astringents for this purpose. Its other applications as an internal remedy are too vague or unimportant to require notice here.——Externally it is commonly considered to act as an escharotic. It occasions however little decomposition of the part to which it is applied, and can scarcely be considered a corrosive. On the other hand it is a powerful stimulant, and seems to possess marked virtues in altering the action upon the surface of ulcers, and thus disposing them to heal. Hence sulphate of copper is much employed by many in treating recent chancres, and indolent, ill-conditioned sores. For these purposes a solution of two, four or eight grains to the ounce is in common use; or the salt itself is rubbed lightly over the sore. It forms likewise a good astringent lotion for chronic ophthalmia. In a state of great concentration the solution is a powerful styptic, and is therefore employed for arresting hemorrhage.

The doses of its only officinal preparation are *Cupri sulphas* gr. ss. ad gr. ii. tonic; gr. vi. ad gr. xii. emetic.

CURCUMA. *Rhizoma (Root, D.) of Curcuma longa, L. W. Spr. Turmeric.*

For. Names.—*Fren.* Racine de Curcuma.—*Ital.* and *Span.* Curcuma.—*Ger.* Curcumei; Kurkuma; Gelbwurz.—*Swed.* Gurkmeje.—*Dan.* Gurkemejo.—*Arab.* Zirsood.—*Pers.* Zirdchoobeh.—*Tam.* Munjil.

Figures of Curcuma longa in Hort. Malabar. xi. 11.—Nees von E. 59.—Botan. Reg. 1825.—Steph. and Ch. iii. 107.

This aromatic is considered to be the Κυπειρος ινδικος of Dioscorides (Féc).

Natural History.—The plant which produces it is the *Amomum Curcuma* of some botanists, the *Curcuma longa* of Linnæus, Willdenow and Sprengel, a species belonging to the Linnæan class and order *Monandria Monogynia*, and to the natural family *Drimyrrhizeæ* of Decandolle or *Zingiberaceæ* of Lindley. It is native in various parts of Eastern Asia, and is much cultivated in China, Cochinchina, Hindostan, and the isles of the Indian ocean. It is raised from cuttings of the root. An English acre yields about two thousand pounds of turmeric in the fresh state. The plant has a perennial root, which is composed of a solid root-stock with many ramifications about the size of the little finger, and of numerous root-fibres, several of them terminated by tubercles about as big as a hazel-nut. The root-stock and its branches are yellow, the tubercles white. The root pushes up annually a number of large root-leaves about two feet long, in the midst of which the

flower is formed upon a short, naked peduncle. Turmeric consists of the branches of the root-stock. These when dry constitute cylindrical masses slightly curved, bluntly pointed at one end, scarcely so thick as the little finger, marked externally with transverse parallel rings, dense, hard and not very brittle, yellow on the external surface, reddish-brown and somewhat glistening within. A variety of it, not so common in the markets of Europe, called Round, or sometimes Chinese, turmeric, and generally thought to be produced by the same plant, is in roundish masses, somewhat pointed in the centre of the rings, but otherwise identical with long turmeric. Both possess a peculiar odour, and a bitterish, aromatic, somewhat acrid taste, like that of ginger, but not so hot. The powder is lemon-yellow.

Chemical History.—Turmeric imparts its colour and taste both to water and spirit. The colour is altered to reddish-brown by alkalis. Turmeric is composed of about a fourth of its weight of yellowish starch, a small proportion of acrid volatile oil, an uncrystallizable yellow colouring matter named Curcumin, and other unimportant principles. Curcumin is obtained by preparing an etherial extract from the alcoholic extract of turmeric. It is brown in mass, yellow in powder, little soluble in water, freely soluble in alcohol, ether, and the oils, fusible at 104°, and rendered brown by the action of alkalis.

Adulterations.—Turmeric is not subject to adulteration, but is sometimes spoiled by contact with castor-oil, in consequence of being packed on shipboard between the skin-bottles or "duppers" in which that oil is often brought to Europe. When thus injured, it is known by its brown colour and want of mealy efflorescence.

Actions and Uses.—This drug is of more importance as a condiment and dye-stuff than as a medicine strictly so called. It is a warm, aromatic carminative, and an essential ingredient of curry-powder. The infusion, or paper stained with it, is familiarly used in pharmacy as a test of alkalinity.

CUSPARIA, *E. L.* ANGUSTURAE CORTEX, *D.* *Bark of Galipea officinalis, Hancock, Med. Bot. Trans.* (*Edin.*) *Bark of Galipea Cusparia, DC.* (*Lond.*) *Bark of Bonplandia trifoliata, W.* (*Dub.*) *Angustura-bark.*

TESTS, *Edin.* Its outer surface is not turned dark-green, nor its transverse fracture red, by nitric acid.

INFUSUM CUSPARIAE, E. L.

PROCESS, *Edin. Lond. Dub.* Take of Angustura, five drachms (two, D.); Boiling (distilled, L.) water, one pint (half a pound, D.) Infuse for two hours in a covered vessel and strain through linen or calico.

TINCTURA CUSPARIAE, E. TINCTURA ANGUSTURAE, D.

PROCESS, *Edin. Dub.* Take of Angustura, in moderately fine powder, four ounces and a half (two ounces, D.); Proof-spirit, two pints (old wine measure, D.) This tincture is made like the tincture of cinchona, and most expeditiously by the process of percolation (*Edin.*) Infuse for fourteen days, and strain (*Dub.*)

For. Names.—*Fren.* Ecorce d'Angusture.—*Ital.* Angustura.—*Ger.* Angusturarinde.—*Dan.* and *Swed.* Angustura.

Figures of Galipea officinalis in Med. Bot. Trans. 1829, i. 2.—and of Galipea Cusparia as Bonplandia trifoliata in Nees von E. 384.—Hayne, i. 18.—Roque, 143.—Steph. and Ch. iii. 149.

Angustura-bark was first made known in Europe in 1788 by Dr Ewer of Trinidad; and it was so called from the town of St Thome de Angostura on the Orinoco, whence it is still derived. Its botanical source was unknown till Humboldt and Bonpland announced the discovery of the plant during their travels in tropical America; and from their specimens Willdenow in 1802 established for it a new genus and species under the name of *Bonplandia trifoliata*, which was adopted for many years by European pharmacologists, as the true botanical reference. Humboldt himself named it *Cusparia febrifuga* from one of the American names for the bark. But Auguste de St Hilaire subsequently showed that the genus is not a new one, and that the plant belongs to the old genus Galipea, to which he accordingly referred it under the name of *Galipea Cusparia*. It is not improbable that one variety of Angustura-bark may be supplied by this species. But satisfactory evidence has been more lately brought forward by Dr Hancock,—who resided for some time in the district which produces the bark of European commerce,—that it is obtained from a different species of the same genus, which he has described under the name of *Galipea officinalis* (Med. Bot. Trans. 1829). These plants belong to the Linnæan class and order *Diandria Monogynia*, and to Lindley's Natural family *Rutaceæ*, and the subdivision *Diosmeæ* of the same order in Decandolle's arrangement. The two species seem essentially different. For, not to mention other more minute distinctions, Humboldt's plant is a magnificent forest tree, often attaining the altitude of 80 feet; while that of Hancock is only a tall shrub, seldom attaining twenty feet in height, and having a stem never above five inches in diameter. The *Galipea Cusparia* is probably a native of the Columbian provinces of Cumana and Barcelona to the north of the river Orinoco. The *Galipea officinalis* was observed by Dr Hancock growing abundantly in the Missiones of Carony, Tumeremo, Uri, Alta-Gracia, and Cupapui in Columbian Guiana, to the south of the same river and about two hundred miles from the ocean.

Chemical History.—Angustura-bark, as imported into Europe, is in flat pieces or incomplete quills, from two to eight inches long, between half an inch and an inch and a-half in breadth, from half a line to three lines in thickness, and composed of the epidermis and proper bark. Its outer surface is dirty grayish-yellow in colour, often speckled in the smaller pieces with lighter gray spots and elevations; the inner surface is dull brown; and the substance of the bark is yellowish-brown. The transverse fracture is smooth and somewhat resinous to appearance. The powder has a grayish-

yellow colour, somewhat like that of rhubarb. It has a peculiar odour, and a bitter, aromatic, hot, and not unpleasant taste. It imparts its properties to water, alcohol, and proof-spirit. The first and the last of these menstrua are used for making the officinal *Infusum* and *Tinctura cuspariæ.* The infusion, which has an orange colour, yields a grayish precipitate with solution of sulphate of iron, a slate-coloured one with tincture of galls, and none with solution of ferrocyanide of potassium. The bark consists, according to Fisher, of 3.7 per cent of bitter extract, 3.6 bitter resin, 5.7 gum, 0.3 volatile oil, and 89.1 ligneous fibre. But it appears also to contain nearly 1.5 per cent of a peculiar, neutral, crystalline principle, which is bitter and somewhat acrid, fusible at 112° F, soluble freely in rectified spirit, moderately in water, but not in ether or volatile oils, soluble readily in acids, and more sparingly in alkalis, and yielding if dissolved in acids a whitish precipitate with tincture of galls. This substance, which is probably the most important of the active principles of the bark, and which has therefore been named *Cusparin,* is obtained in an impure state by evaporating spontaneously a cold alcoholic tincture of the powder, which is afterwards exposed to a temperature of 32° or lower; and the crystals thus obtained may be purified by repeated crystallization from alcohol and agitation with ether and hydrated oxide of lead (Saladin).

Adulterations.—The Angustura-bark of this country is seldom adulterated. But on the continent a most serious fraud has been often practised by the substitution of a highly poisonous bark, long erroneously conceived to be that of the *Brucea ferruginea* or *antidysenterica,* an African tree belonging to the Natural family *Terebinthaceæ.* This bark, commonly termed False-Angustura, presents externally a dirty grayish-yellow ground, with numerous irregular prominent spots or tubercles of a lighter gray tint; which appearances are in the larger pieces displaced in patches, or entirely, by a uniform, loose, bright rusty-coloured efflorescence. The speckled gray pieces alone bear some resemblance to the smaller pieces of true Angustura, but are easily distinguished by their greater thickness,—their far more intense bitterness, without either aroma or pungency,—and also, as the Edinburgh College has indicated, by the transverse fracture becoming bright red when touched with nitric acid. Another excellent character mentioned by the College, but applicable only where rusty specks exist, is that such spots become deep bluish-green with the same acid; which on the other hand scarcely affects the true bark. Nitric acid does not similarly alter the spurious bark where it is quite free of rusty efflorescence. Fatal accidents from the substitution of the spurious for the true bark were at one time not uncommon on the continent; and in Austria they were so frequent, that upon one occasion the government ordered the whole Angustura-bark in the empire to be destroyed. This adulteration has never been publicly noticed in

Britain, and experienced wholesale and retail dealers, whom I have consulted both here and in London, were unaware of its existence. In 1842 however, Dr Moore Neligan of Dublin informed me, that, on inquiring for Angustura-bark at an extensive and respectable drug-warehouse in that city, he got the spurious bark; which proved to have been part of a considerable stock kept in the establishment since at least the beginning of this century, but never previously dispensed. From specimens I owe to the kindness of Dr Neligan there can be no doubt of the accuracy of his observation; so that druggists ought to be aware of the possible risk even in this country of so serious an error. The spurious bark is not, as was at first supposed, the product of the *Brucea ferruginea*. In 1834 I ascertained from specimens sent to me from Calcutta by Dr Jackson, that it is nothing else than the bark of *Strychnos Nux-vomica;* and others have arrived at the same conclusion.

Actions and Uses.—In consequence of its great liability to so serious an adulteration, Angustura-bark has fallen into disrepute and neglect in most parts of Europe except Britain. In large doses it is somewhat emetic and purgative in its action; and in smaller doses it is tonic and febrifuge. Its febrifuge virtues have been much extolled by Dr Hancock; who found that, in a very malignant bilious intermittent, like yellow-fever, which ravaged St Thome de Angostura and the neighbourhood, it was much superior even to cinchona. It has not been observed however to possess the same superiority in the ordinary intermittents of continental Europe, but on the contrary seems entitled to rank as a febrifuge only with other aromatic bitters. It is at present much in use as a stomachic tonic in dyspepsia, in which it appears to improve the appetite, remove acidity, and open the bowels. It is also of undoubted service in the chronic stage of dysentery, and in chronic diarrhœa, especially as these diseases present themselves in warm climates. Dr Hancock farther found it to be a valuable tonic in the dropsies which not unfrequently succeed the severe intermittents of Guiana; and its use has likewise been extended to the treatment of dropsies generally, where reaction does not exist.

The officinal preparations of Angustura-bark, with their doses, are as follows: *Cusparia*, E. L.; *Angusturæ cortex*, D. gr. x. ad dr. i. *Cuspariæ infusum*, E. L. fl.dr. iv. ad fl.unc. iv. *Cuspariæ* (*Angusturæ*, D.) *tinctura*, E. D. fl.dr. ss. ad fl.dr. ii.

CYDONIA, *L.* *Seeds of Cydonia vulgaris, DC.—Willd. Hort. Berol. Quince-seeds.*

DECOCTUM CYDONIÆ, L.

PROCESS, *Lond.* Take of
Quince-seeds, two drachms;
Distilled water, a pint.
Boil with a gentle heat for ten minutes; and then strain.

FOR. NAMES. — *Fren.* Coing. — *Span.* Membrillo. — *Port.* Marmelo. — *Ger.* Quitte.—*Swed.* Quitten.—*Dan.* Qvaeden.—*Pers. Arab.* and *Tam.* Bedana.

FIGURES of Cydonia vulgaris in Hayne, iv. 47—as Pyrus Cydonia in Steph. and Ch. ii. 115.—Nees von E. 305.

THE QUINCE was the Κυδωνιον μηλον of Dioscorides, and was used by him as a medicinal fruit.

The *Cydonia vulgaris* or *Pyrus Cydonia*, the plant which produces it, is a low tree, a native of Candia, now cultivated in the south of Europe, and thriving also under cultivation in the south of England. It belongs to the Linnæan class and order *Icosandria Pentagynia*, and to the Natural family *Rosaceæ* of Decandolle and *Pomaceæ* of Lindley. The fruit is an apple of a roundish angular shape. It contains several ovate, pointed, plano-convex seeds, which are the only officinal part of the plant. The fruit is fragrant, but austere to the taste. Its odour is said by Wöhler to be due to oenanthic ether. The external coat or episperm of the seeds has a bland mucilaginous taste; but their substance or albumen has a ratafia flavour, like the seeds of other pomaceous plants. Boiling water dissolves out the mucilaginous constituent and becomes an emulsive fluid, the officinal *Decoctum cydoniæ*. The mucilaginous principle is considered by Dr Pereira to be a peculiar variety of gum; which, like arabin, is soluble in cold or boiling water, and gelatinizes with sesquichloride of iron; but, unlike that principle, is not affected by silicate of potash.

Quince-mucilage possesses the demulcent properties of mucilaginous fluids in general; but it is now almost abandoned in British practice, and the seeds may without injury be omitted in the Pharmacopœias.

CYMINUM. See *Cuminum.*

DAPHNE MEZEREUM, *D.* See *Mezereon.*

DATURA STRAMONIUM, *D.* See *Stramonium.*

DAUCI RADIX, *E. L. D.* *Root of Daucus Carota, var. Sativa, L. W. DC.—Common carrot.*

DAUCI FRUCTUS, *L.* DAUCI SEMINA, *D.* *Fruit of Daucus Carota, var. sylvestris.*

CATAPLASMA DAUCI, D.

PROCESS, *Dub.* Take of Carrots, a sufficiency, and boil them till they are soft enough to make a poultice.

FOR. NAMES.—*Fren.* Carotte.—*Ital.* Carota.—*Span.* Zanahoria hortense.—*Port.* Cenourca.—*Ger.* Möhre.—*Dut.* Geele wortel.—*Dan.* Gulerod.—*Russ.* Morkov. —*Arab.* Jezer.—*Pers.* Zeidek.—*Tam.* Carrot kalung.

FIGURES of Daucus Carota in Nees von E. 287.—Hayne, vii. 2.—Engl. Bot. 1174. —Steph. and Ch. i. 56.

Natural History.—The Carrot is the Σταφυλινος of Dioscorides. It grows naturally in almost every country in Europe and also in many parts of Asia. It belongs to the Linnæan class and order *Pentandria Digynia*, and to the Natural family *Umbelliferæ* of Decandolle or *Apiaceæ* of Lindley. There are two varieties of it, the wild and the cultivated carrot, the *Daucus Carota sativus* and *sylvestris* of botanists, both of which are officinal. It is a biennial plant. The wild variety, which is common upon roadsides, among hedge-rows, and in dry meadows, has a fusiform, slender, pale yellowish-white, branched, and woody root, possessing a peculiar aromatic odour, and a bitter, acrid, disagreeable taste. The fruit is a line in length or half as long again, brownish, flat, oval, provided with several rows of long, whitish cilia, of a powerful peculiar odour, and a strong, aromatic bitterish taste. The fruit, commonly called carrot-seed, is officinal in the Pharmacopœias of London and Dublin, but is scarcely put to any use. The cultivated variety of the carrot, officinal in all the Pharmacopœias of this country, produces a much larger root than the other, more fleshy, less ligneous, not branched in general, more orange in colour, of the same odour, but of an agreeable, sweet aromatic taste, free alike of bitterness and acridity. The seeds of this variety are larger and less powerfully aromatic than wild carrot-seed. The cultivated carrot is officinal on account of its root.

Chemical History.—Carrot-seed contains both fixed and volatile oil, the latter of which is the source of its medicinal properties. The root of the cultivated variety contains a trace of the same volatile oil, a neutral crystalline red-coloured resinoid substance, called Carotin, various salts, albumen, mucilage, sugar both crystalline and uncrystallizable, pectic acid, and lignin, which in the finer qualities is so pulpy and tender as to be digestible.

Actions and Uses.—The carrot is one of the most nutritive of roots; for it contains about ten per cent of alimentary principles. In medicine it is only used in the form of poultice to malignant, foul, or indolent ulcers, in all of which it often relieves pain and lessens the discharge, while in the last two it sometimes induces healthy action. Carrot-seed is stimulant and carminative, and has been sometimes employed on the latter account. By Dioscorides it was esteemed an emmenagogue, diuretic, and antidote for poisoned bites, and was also thought to favour conception.

The dose of *Dauci fructus*, L.—*semina*, D. is scr. i. ad dr. i.

DELPHINIUM STAPHISAGRIA, *D.* See *Staphisagria.*

DIANTHUS CARYOPHYLLUS, *D.* *Flowers of Dianthus Caryophyllus, L. W. DC. Spr.* *Clove-pink.*

The Clove-Pink or carnation is retained in the Dublin Pharmacopœia on account of its colour, which is imparted to water, and

is therefore of some service in making infusions and mixtures. It is the *Dianthus Caryophyllus* of botanists, a perennial plant belonging to the Linnæan class and order *Decandria Digynia*, and to the Natural family *Caryophyllaceæ*. It occurs native in the south of Europe, is a doubtful native of this island, but is everywhere cultivated in gardens on account of the beauty and fragrance of its flowers. The petals have a bitterish, aromatic, slightly-astringent taste. They have not been analyzed. At one time they were considered stimulant, especially in relation to the nervous system, and were used in fever, and in functional nervous disorders.

DIGITALIS, *E. D.* DIGITALIS FOLIA, *L.* *Leaves of Digitalis purpurea, L. W. Spr.* *Foxglove.*

DIGITALIS SEMINA, *L.* *Seeds of Digitalis purpurea.*

Extractum Digitalis, E.

Process, *Edin.* This extract is best prepared by any of the processes indicated for extract of Conium.

Infusum Digitalis, E. L. D.

Process, *Edin. Lond. Dub.* Take of
Digitalis dried, two drachms (one, L.)
Spirit of cinnamon, two fluidounces (one, L., half an ounce, D.)
Boiling water, eighteen fluidounces (half a pound by weight, D.—distilled, a pint L.)
Infuse the digitalis for four hours in a covered vessel; strain through linen or calico; and add the spirit.

Pilulae Digitalis et Scillae, E.

Process, *Edin.* Take of
Digitalis, and
Squill, of each one part.
Aromatic electuary, two parts.
Beat them into a proper mass with conserve of red roses; and divide it into four-grain pills.

Tinctura Digitalis, E. L. D.

Process, *Edin.* Take of
Digitalis dried, in moderately fine powder, four ounces;
Proof-spirit, two pints.
This tincture is best prepared by percolation as directed for tincture of capsicum. If forty fluidounces of spirit be passed through, the density is 944, and the solid contents of a fluidounce amount to twenty-four grains. It may be also made by digestion.

Process, *Lond.* Take of
Digitalis dried, four ounces;
Proof-spirit, two pints.
Macerate for fourteen days, and strain.

Process, *Dub.* Take of
Dried digitalis leaves, rejecting the larger ones, and reduced to fine powder, two ounces;
Proof-spirit, a pint (old wine measure).
Macerate for seven days, and strain.

For. Names.—*Fren.* Digitale Pourprée.—*Ital.* Digitello.—*Span.* Dedalera.—*Port.* Dedaleira.—*Ger.* Fingerhut.—*Dut.* Vingerhoeden.—*Swed.*—Fingerborrsört.—*Dan.* Rod fingerbat.—*Russ.* Naperstianka.

Figures of Digitalis purpurea in Nees von E. 154.—Hayne, i. 45.—Roque, 53.—Eng. Bot. 1297.—Steph. and Ch. i. 18.

Foxglove was unknown as a medicine in ancient times. Those who imagine it may have been the Βακχαρις of Dioscorides do not advert to his description, in which it is said to have an odoriferous flower and root. Van Helmont, Boerhaave, and Haller mention it as a remedy for scrofula, or as a poison; and it was admitted

into the London Pharmacopœia of 1721 on the former account. But the remarkable properties which render it so much in request in the present day were undiscovered till Withering investigated them in 1776.

Natural History.—It is probable that various species of foxglove such as *Digitalis purpurea*, *lævigata*, *grandiflora*, *lutea*, and *tomentosa* may be used for attaining the same medicinal purposes; but that which is chiefly used in Europe, and alone in Britain, is the *Digitalis purpurea*. This is a herbaceous biennial plant, belonging to the Linnæan class and order *Didynamia Angiospermia*, and to the Natural family *Scrophularineæ* of Decandolle, or *Scrophulariaceæ* of Lindley. It grows abundantly in this country, as well as in most temperate and southern countries on the Continent; and it thrives either upon exposed hill-sides and river-banks, or protected in young open plantations. In its first year, it pushes up a tuft of ovato-lanceolate root-leaves; and from the midst of these arises in the following summer a flowering stem, from two to seven feet high, covered with a spike of beautiful, purple, pendulous flowers, and afterwards with numerous capsules which ripen in slow succession. It begins to flower in June, and ripens its seeds in August and September. It is one of the most beautiful ornaments of our hills, banks, and pleasure-grounds. A variety, with white flowers, often seen in gardens, is rare in wild localities. The common officinal part is the leaf. The London College has also admitted the seeds; which, however, though probably more energetic, are troublesome to collect on account of their minuteness, and have therefore never come into use. The leaves are ovate, elliptic-oblong, or ovato-lanceolate, from six to ten inches in length, serrated on the edge, rugose, gray and downy on the under surface, smooth and dark-green above. They are usually gathered, according to the original directions of Withering, in June or July, when the plant is just coming into flower, or soon afterwards. But this is perhaps a needless restriction: at least, I have observed that their bitterness, which probably measures their activity, is very intense both in February and September; and that their extract is highly energetic as a poison in the middle of April before any appearance of the flowering stem. The fresh juice has a faint mawkish odour, and an intensely bitter, nauseous, permanent taste. It is easily evaporated spontaneously without undergoing decay, so as to form a firm extract; and this is the simplest way to make the *Extractum digitalis* of the Edinburgh Pharmacopœia. The leaves have scarcely any odour; but they possess the peculiar taste of the juice. When dried for use, they should first be deprived of their thick, succulent midrib and footstalk, and then exposed to a current of air, or put before a fire, or enclosed in a hot-air-press. When well prepared, the powder has a fine green colour, and retains the intense bitterness of the fresh leaves.

Chemical History.—Digitalis readily imparts its bitterness and

medicinal properties to water, alcohol, ether, or weak acids. With water is prepared the officinal *Infusum digitalis*, the favourite preparation of Withering; and proof-spirit yields the now more familiar *Tincture:* The infusion is rendered dark greenish-black by solution of sesquichloride of iron, and yields a gray precipitate with tincture of galls. The leaves give out ammonia when triturated with lime.—After having been often analysed with doubtful results, M. Homolle discovered an energetic crystalline principle, which is neutral, intensely bitter, somewhat acrid, sparingly soluble in water, moderately so in ether, and easily soluble in alcohol and in weak acids. Homolle's process, as improved by O. Henry, consists in making coarse powder of the leaves into a paste with rectified spirit, expressing the solution, distilling off the spirit, treating the residue with very weak acetic acid, adding infusion of galls to the solution, triturating the precipitate with fine litharge and a little alcohol, digesting the pulp with rectified spirit at a heat not exceeding 104°, filtering and distilling the alcoholic fluid, and shaking the residue with warm ether thrice. What remains is nearly pure digitalin. The empyreumatic oil obtained from the leaves by destructive distillation is powerfully narcotic [Morries].

Adulterations.—Digitalis is little subject to adulteration. Sometimes the leaves of *Verbascum Thapsus*, or Shepherd's rod, and those of *Symphytum officinale*, or Comfrey, are mistaken for it. These however are easily distinguished by being hairy on both sides. Besides, the Verbascum leaf is feebly bitter, and that of Symphytum merely mucilaginous.

Actions and Uses.—The actions of this drug are complex. In large doses it is a narcotico-irritant poison. In medicinal doses frequently repeated it is a sedative of the circulation and a diuretic; and possibly in very small doses it is by reason of its bitterness a tonic. In single large doses it produces stupor, vomiting, and purging, cold sweats, a slow, feeble, irregular pulse, suppression of urine, and death amidst coma and convulsions. In very small doses it is said by some to exert a tonic action upon the stomach; which property is common to most bitter vegetables. But very few use digitalis on this account. In doses somewhat larger, although little immediate effect results from any one of them, it produces by accumulation in the course of two, four, or six days a copious and permanent flow of urine. Similar doses long continued or frequently repeated cause by accumulation softness of the pulse, often with irregularity, and almost always with great reduction in rapidity, such as to 42 or even 35 beats in a minute. This state of the circulation is attended with languor, often with anxiety, generally with an oppressive nausea, occasionally with salivation, not unfrequently with giddiness, dimness of vision, a sensation like sparks before the eyes, headache, and more rarely spectral illusions and delirium; and these effects, if the doses be still continued, may go on increasing till symptoms of poisoning are developed, like

those first mentioned. Some have alleged that the sedative action on the heart is preceded by manifest excitement; which however, in common with many other observers, I have not been able to witness. According to my experience, the sedative and diuretic actions do not concur. I even suspect they are mutually incompatible. Like other cumulative medicines, it may occasion either its sedative or diuretic action for the first time after the doses have been discontinued for some days. The sedative action on the heart and the narcotic action on the nervous system are produced, through whatever channel it is admitted into the body, whether by the mouth, in a clyster, or by injection into a vein.

As a diuretic, digitalis is extensively employed in dropsies of all kinds; but it is applicable chiefly to anasarca, or to those local hydropic effusions which occur in connexion with more general disease of the same kind. It is of little use, though very often given, in simple hydrothorax, hydrops pericardii, or ascites. It is most serviceable in dropsies associated with an enfeebled state of the constitution; and in particular it seldom succeeds in inflammatory dropsy, until reaction is subdued by antiphlogistic means. Dropsies depending on diseased heart are more under its influence than any other kind, and next those connected with diseased kidneys. As a sedative it has been used in febrile diseases and acute inflammations, especially on the continent by the followers of Rasori and of the doctrines of Contro-stimuli; but its influence over the circulating system during a state of febrile action is very questionable. It has also been used as a sedative in active hæmorrhagies, more particularly hæmoptysis; and, through an erroneous induction, in phthisis pulmonalis. In these diseases its reputation was at one time undeservedly high, but is now almost lost. It is of more decided service where the circulation is excited from nervous disturbance merely, as in neuralgia attended with irritative fever. In palpitation, whether arising from functional irritability of the heart or from organic disease, it is frequently effectual, but especially in the former case. Its employment as a tonic and deobstruent in scrofula, once rather common, is now deservedly obsolete. The same may be said of its application as an external remedy to the treatment of indolent ulcers, scirrhous enlargement of the glands, scabies, and other chronic eruptions.

The diuretic action of digitalis is best attained by administering small doses thrice a-day. Sometimes it may be brought on in the course of twenty-four or thirty-six hours by giving the same doses twice as frequently or even oftener; but in this manner its sedative influence is more apt to be brought into play, in which case its diuretic action seems to be interfered with. Diuresis is sometimes induced with greater certainty by uniting it with other remedies of similar action, as with bitartrate of potash, or with squill in the form of the Edinburgh *Pilula digitalis et scillæ*. It is also sometimes promoted by a few grains of calomel or mercurial pill once a-day. It

is useful to give some aromatic along with it to prevent its nauseating effect on the stomach. Of its several officinal forms, Withering was partial to the infusion; but the pill and tincture are equally good, if well prepared, and are more convenient. I have seen diuresis induced by rubbing on the abdomen a mixture of the tincture with soap-liniment, or by placing on it cloths soaked with a strong infusion, although the ordinary preparations, as well as other diuretic remedies, had failed when given by the mouth; but this method is uncertain.——The sedative action of digitalis is induced by administering it in moderate doses five or six times a-day, care being taken to reduce them in strength or frequency so soon as the action on the circulation begins, and to watch the patient narrowly while he remains under its influence, in order to avert the risk of undue depression. When the sedative effect becomes too great or has been developed unintentionally, the best mode of counteracting it is by wine and opium conjunctly. Digitalis ought not to be prescribed as a sedative unless the patient be under the daily observation of his medical attendant; and when it is given in very frequent doses, he ought to be seen several times a-day. There is no advantage in the large doses of a drachm and upwards of the tincture, which have been administered by some; and such doses must be often dangerous.

The digitalin of Homolle, in the dose of a tenth of a grain or less, causes great slowness of the pulse, occasionally diuresis, often headache, giddiness, yawning, and muscular prostration. It has been found in Paris to be serviceable in dropsy as a diuretic, and as a sedative in phthisis, palpitation, hypertrophy of the heart, and pericarditis (Bouchardat). The empyreumatic oil of the leaves causes death amidst convulsions and coma.

The preparations of digitalis, with their doses, are: *Pulvis digitalis* gr. i. ad gr. iii. *Infusum digitalis*, fl. dr. iv. ad fl. unc. ij. *Tinctura digitalis*, min. x. ad min. xx. *Extractum digitalis*, E. gr. ss. gr. i. *Pilulæ digitalis et scillæ*, E. gr. v. ad gr. x.

DIOSMA, *D.* See *Buchu.*

DOLICHOS, *D.* See *Mucuna.*

DRIMYS AROMATICA, *D.* *Bark of Drimys aromatica, DC. Winter's bark.*

Drimys aromatica figured as Drimys Winteri in Nees von E. 372—Hayne, ix. 6.—St. and Ch. iii. 178.

Towards the close of the sixteenth century, Captain Winter found the *Drimys aromatica* on the coasts of the Straits of Magellan, and the bark was afterwards much employed as an antiscorbutic under its discoverer's name. It is the *Wintera aromatica*, *Drymis winteri*, and *Winterana aromatica* of different botanists. It is a

fine forest-tree, belonging to the Linnæan class and order *Polyandria Tetragynia*, and to the Natural family *Magnoliaceæ* of Decandolle, or *Winteraceæ* of Lindley. It occurs at the Straits of Magellan, and in Chili, Peru, and New Grenada (Lindley); but there is reason to suppose that the species of these various localities is not quite the same. The bark met with in English commerce is in quills a foot and more in length, from one to two inches in diameter, several lines in thickness, pale grayish-red externally, with a few oval darker spots, free from transverse or longitudinal cracks, and of an agreeable aromatic pungency. Specimens in my collection, presented to my predecessor Dr Duncan by Mr Bowen of the Royal Navy, and brought from the Straits of Magellan, have a much firmer texture, a more resinous fracture, and far greater pungency than the commercial Winter's bark; and they present some transverse fissures externally.——Winter's-bark contains an acrid resin, an acrid volatile oil, a little tannin (Henry), and other immaterial ingredients. It is an excellent aromatic, and well deserving attention, had we not many similar remedies. In taste and acrimony it closely resembles canella-bark, which is always sold for it in this country, unless *true* Winter's bark be asked for. Few druggists now keep it.

Its dose is dr. ss. ad dr. i.

DRYOBALANOPS CAMPHORA, *D.* See *Camphora.*

DULCAMARA, *E. L.* SOLANUM DULCAMARA, *D.*

Stems (twigs, E.) of Solanum dulcamara, L. W. Spr. Bittersweet.

DECOCTUM DULCAMARAE, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of Dulcamara, chopped, an ounce; Water, twenty-four fluidounces; Mix them; boil and concentrate by evaporation to sixteen fluidounces (a pound, D.)

FOR. NAMES.—*Fren.* Douce-amère; Morelle.—*Ital.* Morella; Solatro.—*Span.* Dulcamara.—*Port.* Dolçamarga.—*Ger.* Bittersüss.—*Swed.* Qwasweed.—*Dan.* Bittersode.—*Dut.* Bitterzoet.—*Russ.* Paslen sladkogorskoi; Psinki.

FIGURES of Solanum dulcamara in Nees von E. 188.—Hayne, ii. 39.—Roque, 68.—Eng. Bot. 365.—Steph. and Ch. i. 17.

THE SOLANUM DULCAMARA is believed to have been the Αμπελος ἀγρια, or wild vine, of Dioscorides; which was used by the Greeks as a remedy for dropsy. After being long abandoned, it was revived in modern times by Boerhaave as a sudorific and alterative tonic.

Natural History.—It is a native of Britain, where it grows chiefly in hedges; and it is also widely diffused throughout the temperate parts of Europe, Asia, and America. It belongs to the Linnæan class and order *Pentandria Monogynia*, and to the Natural family *Solanaceæ.* It is a perennial climber about ten feet in

length. It bears clusters of purple flowers in June and July, and afterwards little scarlet berries. The officinal part is the stem or twigs, which are commonly chosen about the thickness of a goose-quill. There is no satisfactory authority for the unusual preference given in every Pharmacopœia to this part of the plant; and according to all analogy, especially in the family of which it is a member, the leaves ought to be preferred. The twigs have a faint nauseous odour when bruised in their fresh state, and a bitter taste followed by some sweetness; whence are derived the specific and vernacular names of the plant. They should be gathered towards the close of autumn, when the leaves have dropped. According to Dr Duncan twigs of two-years' or three-years' growth should be chosen; but Geiger prefers those which are only a single year old. When dried they are light, hollow, wrinkled, without odour, but of the same taste with the fresh plant.

Chemical History.—They impart their properties to water and spirit; the former of which is the officinal solvent for the only preparation in the British Pharmacopœias, the *Decoctum dulcamaræ.* The plant has been found by analysis to contain both a sweetish, bitter extract (Pfaff), which some have considered a principle under the name of Picroglycion or Dulcamarin, and an alkaloid of narcotic properties named Solania (Desfosses), besides gum, gluten, and other unimportant ingredients. Its active principle is probably the alkaloid solania; which, however has not yet been fully examined. It is obtained impure by precipitating the expressed juice of the plant with ammonia, and then purified by repeated solution in rectified spirit and the decolorizing agency of animal charcoal. It is white, pearly, obscurely crystalline, permanent in the air, of a faintly bitter mawkish taste, soluble sparingly in alcohol, scarcely at all in water, but readily in diluted acids, which it neutralizes, without forming crystallizable salts. Solania is obtained more easily from the common nightshade, or *Solanum nigrum*, than from the present species; and its existence in the *S. dulcamara* has even been denied altogether (Biltz). The same alkaloid has been detected by Wackenroder in the young shoots of the potato-plant.

Dulcamara twigs are not subject to adulteration in this country. They may be distinguished from other twigs by their peculiar bitter-sweet taste.

Actions and Uses.—The actions of this remedy are obscure. The berries are usually considered poisonous, and the leaves are thought to be narcotic. But the power of both is feeble, the ideas entertained to the contrary having probably arisen from this, as well as other species of solanum, having been confounded with the more energetic belladonna, which received at one time the same generic name. Dulcamara-twigs however seem to be slightly narcotic. Their chief use in medicine has been founded on the supposition, that they possess the properties of sudorifics and alteratives. The

diseases in which they have been principally employed are, "cutaneous disorders, especially lepra, syphiloid diseases, rheumatic and cachectic swellings, ill-conditioned ulcers, scrofula, indurations from milk, leucorrhœa, jaundice, and obstructed menstruation" (Duncan). They are given in the form of decoction three or four times a-day; and the addition of some aromatic water is of service to cover their mawkish taste. This decoction is probably neither more nor less useful than most other diet-drinks. I have seen it apparently effectual in lepra and psoriasis.—The Solania of Desfosses seems a narcotic poison of considerable energy; for two grains killed a rabbit with symptoms of coma and paralysis, and doses somewhat larger caused vomiting and drowsiness in dogs and cats. No trials have yet been made of its medicinal properties; which seem nevertheless to deserve investigation, if it is so powerful and pure a hypnotic in the instance of animals as some allege.

The doses of the only officinal form of Dulcamara are—*Decoctum dulcamaræ*, fl.unc. ii. ad fl.unc. iv.

ELATERIUM, *E. L. D.* *The feculence of the juice of the fruit (Edin.)—the fresh gourds (Lond.)—the fruit, feculence, and leaves, (Dub.)—of Momordica Elaterium. L. W. Spr. DC. Elaterium.*

TESTS, *Edin.* Colour pale gray. When exhausted by rectified spirit, the solution concentrated and poured into hot diluted Aqua potassæ, deposits on cooling minute silky colourless crystals, weighing from a seventh to a fourth of the elaterium.

ELATERIUM E. EXTRACTUM ELATERII, L. D.

PROCESS. Take of the fruit of Momordica Elaterium before it is quite ripe (when ripe, L. D.) any convenient quantity. Cut the fruit and express the juice gently through a (very L.) fine sieve. Allow the liquid to rest (for some hours, L. D.) till it becomes pretty clear. Pour off the supernatant liquid, which may be thrown away; and dry the feculence with a gentle heat.

FOR. NAMES.—*Fren.* Concombre sauvage.—*Ital.* Cocomero asinino.—*Span.* Cohombrillo silvestre.—*Port.* Pepino de San Gregorio.—*Ger.* Springgurke.—*Dut.* Ezels komkommer.

FIGURES of Momordica Elaterium in Nees von E. 272.—Hayne, viii 45.—Roque, 173.—Steph. and Ch. i. 34.—Bot. Mag. 1914.

THE name ELATERIUM or Ελατηριον, applied by the ancients probably to several purgatives, is now appropriated by the London College to designate the fruit of the *Momordica Elaterium*, but is more correctly used by the College of Edinburgh, in conformity with its Dioscoridean signification, as well as the prevalent practice in English trade, to denote the officinal substance obtained from the fruit. The plant has been well known in medicine since the time of the Greek physicians, by whom it was called Σικυς 'αγριος, and sometimes Ελατηριον, in common with the inspissated juice of the fruit.

Natural History.—The *Momordica Elaterium*, or *Ecbalium Ela-*

terium of some botanists, the Wild or Squirting Cucumber, is an annual creeper, belonging to the Linnæan class and order *Monœcia Monadelphia,* and to the Natural family *Cucurbitaceæ.* It grows naturally on poor soils in Greece, as well as in other parts of the south of Europe; and it is extensively cultivated in England for medicinal purposes. Its stem is about two feet long. It flowers in July, and produces in August an oval, green fruit, about an inch and a-half long, which, on quitting the foot-stalk when ripe, suddenly, in consequence of the elastic structure of its parietes, discharges with considerable force many brown seeds and a slimy juice through the aperture at its base. The officinal elaterium is obtained from the juice around the seeds. This juice is discharged with the seeds if the fruit be allowed to burst; but it is collected a little before the period of ripening. At first it is transparent and greenish; but in less than a minute, it becomes opake, and a gray precipitate begins to separate. It is freed of impurities by squeezing it gently through a fine sieve, because filtration would keep back its most active part. One variety of the drug, which is usually brownish-black and compact, is prepared on the continent by gently evaporating the whole strained liquor, and is therefore an inspissated juice. Another variety, which is pale gray and friable, is obtained chiefly in Britain according to the process of the Pharmacopœias, by allowing the insoluble matter suspended in the juice to settle, rejecting altogether the liquid part, and drying the sediment only,—which, as Dr Clutterbuck first proved, is the only very active portion of the juice. The pale elaterium, incorrectly called by some of the Colleges an extract, is much more powerful and uniform than the black sort. Forty gourds yield only six grains of it. The leaves, though officinal in the Dublin Pharmacopœia and not without activity, are now scarcely ever put to use.

Chemical History.—Good elaterium is pale-gray, light, and friable, without odour, but of an intensely bitter taste, which is possessed also by the fruit itself, as well as the leaves, stem, and root of the plant. Its best solvent is alcohol. Dr Paris found it to contain 28 per cent of starch, 26 extractive matter, 25 ligneous fibre, 5 gluten, a little moisture, and 12 of a green resinoid substance, which he called Elatin, and in which he ascertained that the active properties of the drug resided. Dr Morries, however, and about the same time Mr Hennell, both showed that this substance is not a pure principle, but consists of chlorophyll in combination with a colourless crystalline substance, termed Elaterin. This is easily obtained by the process of Dr Morries, namely, by exhausting elaterium thoroughly with boiling rectified spirit, concentrating the tincture so long as no separation takes place, and then pouring it while hot into a weak boiling solution of potash. The potash retains the chlorophyll, and the elaterin crystallizes on cooling in capillary colourless crystals. The proportion of elaterin thus ob-

tained varies from 15 to 25 per cent of the crude drug; but black elaterium does not give above six per cent. It is in very delicate colourless crystals, which are striated sattiny prisms with a rhombic base. It is permanent in the air, without odour, but of an intensely bitter and somewhat acrid taste. It fuses at 212°, and by a strong heat is decomposed, with the evolution of white acrid inflammable vapours. It is readily soluble in rectified spirit, sparingly in ether, fixed oils, and weak acids, but not in water or weak alkalis. It is a neutral body containing no azote, but having the constitution $C^{20} H^{14} O^5$ (Zwenger).

Adulterations.—Elaterium, as sold in Britain, is seldom adulterated expressly; but it varies in strength, owing probably to irregularities in the time of collecting it or in the mode of preparing it. It should be pale gray and friable, not brown or compact; and, as the Edinburgh College has indicated, it ought to yield at least fifteen per cent of elaterin. There is no simpler pharmaceutic test of its quality than is furnished by its analysis.

Actions and Uses.—Elaterium is in point of action a pure irritant. Through means of this action it is a cathartic, and one of the most powerful kind. It is in doses of a few grains a most violent acrid poison, causing diffuse inflammation of the stomach and bowels, characterized by vomiting, griping pain, and profuse diarrhœa. Various parts of the plant and various preparations from them have been long more or less used in medicine. But it is only since the clinical investigations of Ferriar and the observations of Clutterbuck on the preparation of the drug, that it has come into general use as an active purgative. It produces copious watery evacuations, attended with considerable depression of the circulation and nervous system. It is therefore often used in dropsy, when it is thought right to attempt the removal of the effused fluid by the cathartic method of cure. But it is also capable of being advantageously applied to more general purposes as a brisk purgative, if combined with other less active remedies of the same kind. It is usually given in the form of pill to the extent of an eighth or a fourth of a grain; and seldom is it found necessary to go so far as one grain to obtain profuse evacuations, if its quality be good. As all its active part is soluble in rectified spirit, and fine division is probably the most effectual precaution to take against its griping tendency, a tincture might be introduced with advantage into the Pharmacopœias, and administered in some aromatic mucilaginous vehicle. Many have been disappointed in using elaterium,—plainly on account of its irregular strength; and hence it has been proposed by some to introduce its active principle elaterin into practice. This substance often acts on the bowels in the dose of a sixteenth of a grain, and I have known a tenth of a grain to occasion severe vomiting and purging. An excellent purgative solution is made with one grain of elaterin, a fluidounce of rectified spirit, and four drops of nitric acid; of which between

thirty and forty minims seldom fail to act freely (Morries). A fifth of a grain of the principle will kill a rabbit in two days.

The doses of the only officinal preparation of elaterium are: *Elaterium*, E. *Extractum elaterii*, L. D. gr. $\frac{1}{8}$ ad gr. i.

ELEMI. *Concrete resinous exudation from one or more unascertained plants (Edin.) Resin of Amyris elemifera, L. (Dub. Lond.) Elemi.*

UNGUENTUM ELEMI, L. D.

PROCESS, *Lond.* Take of
Elemi, a pound;
Common turpentine, ten ounces;
Suet, two pounds;
Olive-oil, two fluidounces.
Melt the elemi in the suet; remove the vessel from the fire; mix immediately with them the turpentine and oil; and express through linen.

PROCESS, *Dub.* Take of
Elemi, a pound;
White wax, half a pound;
Prepared lard, four pounds,
Make an ointment, and strain it hot through a sieve.

FOR. NAMES.—*Fren. Ital. Port. Ger. Dut. Dan.* and *Swed.* Elemi.—*Span.* Goma de limon.

Natural History.—Accurate information is still wanting relative to the botanical and primary commercial source of the resinous substance known in this country by the name of ELEMI. It was referred by Linnæus to the *Amyris elemifera*, under which title are comprised more than one species of plant; and the resin has not been traced correctly to any of them. The Irish and English Colleges are clearly wrong therefore in adopting this reference. Almost all the elemi in the London market, at one time came from Holland (Pereira); but this is believed by wholesale dealers to be a sophisticated article prepared from common frankincense. M. Guibourt has traced to Brazil another variety, which may be produced by a Terebinthaceous tree of that country, the *Icica Icicariba*, to which the commercial drug has been referred by some authorities. The opinion of Martius, who refers the common elemi of commerce to the *Amyris zeylanica*, or *Balsamodendron zeylanicum*, seems untenable, otherwise it would come to Britain directly from its native country Ceylon. A third kind now imported from Mexico, has been ascertained by Dr Royle to be the produce of a new species of *Elaphrium*, which he has named *E. elemiferum*. The term Elemi has been very vaguely applied. I am acquainted with three other resins, all of them commercial, all represented as elemi, and none of them factitious. One obtained at least twenty years ago by my predecessor, has a pale lemon-yellow tint, some translucency, an agreeable terebinthine odour mixed with that of fennel and lemon, and a corresponding bitter aromatic taste. It seems identical with a kind now brought from Manilla, which may be the produce of *Canarium commune*. Another presented to me in 1834, and said to come from Calcutta as East Indian elemi, is in a bamboo reed, and considerably resembles the former, but has a less agreeable

colour, and a weaker, less grateful odour. A third, now common in trade, and imported in masses of one or two pounds in weight, wrapped in a palm leaf, is greenish-white, slightly translucent or opaque, soft when recent, more brittle than the two others when long kept, and analogous, yet different, in odour. One variety of this, which was pointed out to me by Dr Douglas Maclagan, seems to correspond exactly with the resin of *Canarium balsamiferum* sent to me lately from Colombo by the lady of Major-General Walker. The factitious elemi of British trade and the Mexican kind, constitute of course a fourth and fifth variety.

Chemical History.—All the elemis in my possession soften in the mouth and become adhesive. Bonastre says elemi consists of 84 per cent of resin, 12.5 volatile oil, and a little bitter extractive matter; but it does not exactly appear which variety he examined. Its properties being owing in a great measure to its volatile oil, it ought to be preserved in close boxes.

Actions and Uses.—Elemi partakes of the stimulant properties of the resins obtained from the *Terebinthaceæ*. It is never used internally, and not much externally. The officinal *Unguentum Elemi* is employed to stimulate indolent ulcers and issues, and is equivalent to an old and esteemed liniment called the *Linimentum Arcæi*. The drug might be expunged from the Pharmacopœias.

ERGOTA, *E. L.* *An undetermined fungus with degenerated seed of Secale cereale, L. W. Spr.* (*Edin.*) *Acinula clavus, Fries, Syst. Mycolog.* (*Lond.*)

FOR. NAMES.—*Fren.* Ergot; Seigle ergoté.—*Ital.* Allogliato.—*Ger.* Mutterkorn; Roggenmutter.—*Dut.* Spoor.—*Dan.* Söm.—*Russ.* Sporinia; Rojki.

Ergotted Rye figured in Nees von E. Suppl. 1.—Graves and Morries, 32.—Steph. and Ch. iii. 113.

THE period at which ERGOT (Spurred rye, Ergotted rye, *Secale cornutum*, *Secale clavatum*), first became known to naturalists cannot now be ascertained. It first attracted the attention of physicians in 1596 as a cause of epidemic disease in Hessia; and although its medicinal properties seem to have been known in Germany since at least the middle of the subsequent century, they did not become familiar to professional men till the publication of the essays of Desgranges in 1777, and more especially of Stearns and of Prescott of the United States thirty years later.

Natural History.—Much uncertainty prevails as to the exact nature of this substance. The question cannot be fully discussed here; but a short statement may be given of the position in which it stands at present. The Ergot or Spur seems to affect occasionally all the *Graminaceæ*, more rarely the *Cyperaceæ*, and sometimes even the Palms. No plant however presents it so frequently or of such size as common rye, the *Secale cereale*. It is generally thought to arise under the influence of undue moisture; and al-

though this condition seems not to be absolutely essential (Léveillé, Bauer), it is never produced with such certainty as in wet seasons, and in districts where the soil is damp, rain frequent, and the atmosphere still and misty, especially at the time the grain is coming into flower. In these circumstances it is produced according to some by punctures made by insects in the glumes while the substance of the seed is pulpy (Tillet, Read, Fontana, Field); others conceive that it is caused by the spawn or sporidia of a peculiar species of fungus (Decandolle, Léveillé, Nees von Esenbeck, Queckett, Smith),—to which some add that it may be propagated by contact (Fontana), or communication through the soil (Wiggers); and lastly, many insist that nothing further is required for its developement than a moist still air, and damp soil (Tessier, Robert, Willdenow). As to the precise nature of ergot, it was long considered a morbid degeneration of the seed; to which doctrine some added, that the disease is analogous to galls and other vegetable excrescences constituting the nidus of insects. But Decandolle, reviving an old idea advanced by Schreber, endeavoured to prove, that it is a peculiar species of fungus, which is developed in place of the embryo, and to which he assigned the name of *Sclerotium Clavus*. In this opinion he is followed, though with some hesitation, by Fries, who has introduced the ergot into his Systema Mycologiæ under the name of *Spermoëdia Clavus*, a term which has been adopted by Lindley. The most recent doctrine on the subject comprehends the views of Léveillé, Nees von Esenbeck, Smith, Queckett, and Bauer. Léveillé maintains (1826) that every ergotted ear of rye presents amidst the flowers a glutinous substance composed of minute fungi; that under a peculiar irritation thus excited, the embryo undergoes a morbid transformation which constitutes the ergot; and that the ergot without being itself a fungus, nevertheless bears on its apex a small plant of this nature, which he has designated *Sphacelia segetum*. These views have received support from the high authority of Nees von Esenbeck; who found that the body of the ergot does not present the microscopic structure of the fungi, but rather that of the grains, and that the grayish excrescence on its apex is an entire mass of fungous sporidia. The sentiments of Smith, of Queckett, and of Bauer, the latest inquirers on the subject (Linn. Trans. 1840), correspond in the main with those of Léveillé regarding the nature of the great mass or body of the ergot; but they maintain that the excrescence at the apex is merely the shrivelled pericarp and stigma of the aborted seed; and Mr Queckett attempts to show, that the only real fungus in the case consists of an infinite multitude of microscopic sporidia about a 400th of an inch in diameter, which are scattered over the surface of the ergot, and which thickly envelope and impregnate the parts of fructification in the nascent state of the embryo. These sporidia, which are the exciting cause of the ergot, he considers a new species of fungus; and he proposes to call it *Ergotætia aborti-*

faciens. It is evident from these statements that the botanical reference of Ergot in the Edinburgh Pharmacopœia is the nearest approximation to accuracy that is at present attainable. As for that of the London Pharmacopœia, there is no such fungus as *Acinula Clavus* to be found in the author quoted by the College.

The Ergot of rye is a somewhat cylindrical body, slightly curved like the spur of a cock and hence sometimes called Spurred-rye, from a third of an inch to an inch and a-half, or rarely two inches in length, between a line and three lines in diameter, marked commonly with two longitudinal furrows, and terminated at the apex by a pale-gray excrescence, which however is generally rubbed off in what is found in the shops. Externally it presents a dingy purple hue and often a scattered whitish bloom over it; but internally it is pale grayish-red or grayish-white. It emits a peculiar musty odour when pulverized, and has a slightly bitter, sweetish, obscurely acrid taste. It is lighter than water, somewhat of the consistence of horn, hard and brittle if thoroughly dry, but soft and pliant if exposed to a moist atmosphere. With the aid of the microscope its internal structure is seen to consist of minute roundish cells, many of which contain particles of oil; and the bloom on its surface appears composed of the sporidia to which it is believed by most inquirers to owe its origin. Unless kept carefully excluded from the air in dry bottles, it slowly swells and softens, acquires a deep black colour and heavier odour, and becomes infested with numberless brown insects about the size of a small pin's head. Its powder becomes quickly damp and full of animalcules.

Chemical History.—Boiling-water forms with it an acidulous claret-coloured solution, possessing its odour, taste, and actions on the animal body. Alcohol, the alkalis, the strong acids, and various metallic salts cause sooner or later precipitates of various tints with this decoction. Iodine does not indicate starch in it. Sulphuric ether agitated with it removes a fixed oil. Long boiling destroys the activity of the decoction. Strong alkaline liquors acting on ergot itself form a fine lake-red solution. Alcohol, ether, and the volatile oils remove its active part, but little colouring matter. It has been repeatedly analyzed, but with various results. Vauquelin,—who obtained a sweetish oil, a yellow and a violet pigment, phosphoric acid and a vegeto-animal matter prone to putrefaction,—did not connect any of these principles with its active properties. Winkler obtained, besides unimportant ingredients, a rancid acrid oil and a nauseous, acrid extractive matter. Robert erroneously ascribed its poisonous properties to hydrocyanic acid. Wiggers found a little phosphoric acid, gum, sugar, albumen, osmazome, wax, various salts, 35 per cent of fixed oil, 46 per cent of fungin, and 1.25 of a peculiar principle possessing a heavy odour and nauseous acrid taste, which he called Ergotin. These results were justly considered important, inasmuch as the principle Ergotin seemed to concentrate in itself the active properties of the crude drug, and the presence

of so large a quantity of fungin was held to confirm Decandolle's views concerning its nature and origin. Some years ago however, I failed to obtain the ergotin of Wiggers on attentively following his process, and Dr Samuel Wright has since been not more successful. The last author found ergot to consist of 31 per cent of oil, 11.4 fungin, 26 altered starch, 9 mucilage, 7 gluten, 5.5 osmazome, 3.5 colouring matter, and 3.1 salts with free phosphoric acid (3.5 loss); and from careful physiological and therapeutic experiments he arrived at the conclusion, that both the poisonous and medicinal powers of the drug reside in the fixed oil, which may easily be obtained from its powder by agitation with sulphuric ether, and expulsion of the ether by spontaneous evaporation. The more recent inquiries of M. Bonjean in France lead to different conclusions. This author has by experiment arrived at the opinion, that the fixed oil is the source of the poisonous effects of ergot, and he considers its action in this respect to be narcotic, whilst he believes that the peculiar medicinal virtues reside in an extractive matter soluble both in water and alcohol. Bonjean prepares this extract by percolating ergot with cold water, evaporating to a syrup, adding spirit to separate gummy matters, and finally evaporating the alcohol to obtain the active extract.

Adulterations.—Ergot is said to be liable to adulteration with a counterfeit substance made of gyps (O'Shaughnessey) or with paste (Wright). Sometimes the interior is devoured by insects. Much more frequently it is spoiled by age, becoming in that case thicker and more plump, very black, pliant, shining and fetid. The best ergot is dry and easily broken, purplish-black on the surface, pale grayish-red in its substance, lighter than water, free of insects, inflammable and burning with a clear flame, and incapable of forming a dark-blue pulp when its powder is triturated with iodine and water (Wright). It may be added, that according to late experiments ergot picked from growing rye is much more powerful than what is gathered on the barn-floor after the grain has been carried home and threshed (Böttcher and Kluge).

Actions and Uses.—Few substances exert so peculiar an action on the animal economy as ergot. Its most remarkable effects on the healthy body are those produced by its free and long-continued use with the food. The observations made under this head upon animals are not concordant, some having observed diarrhœa, external suppurations, scattered gangrene and dropping away of the toes (Tessier, Robert),—others having witnessed a cachectic state of the body, indicated by extreme muscular wasting and weakness, loss of appetite, frequent pulse, fetor of the secretions and excretions, congestion of the alimentary mucous membrane, excessive contraction of the spleen and enlargement of the liver, enlargement of the absorbent glands, tubercular depositions in the lungs, and non-formation of callus at the ends of fractured bones (Wright). The oil of ergot may be found in the blood of animals thus poisoned with

it. In the human race two distinct diseases have been referred to its protracted use; and since 1596 both of them have been repeatedly observed to prevail as epidemics in various parts of the continent, where rye constitutes a considerable proportion of the food of man. One of these diseases, termed Convulsive Ergotism, is distinguished by the characters of an acute comatose affection,—giddiness, dimness of vision, insensibility, convulsions, imperceptible pulse, and death within two days. The other and more common disorder, termed Gangrenous Ergotism, and resembling that observed by Tessier as well as Robert in animals, commences with weariness and a feeling as if myriads of insects were creeping over the body; in a few days fever sets in, with a tendency to hæmorrhage, rending pains in the arms and limbs, and at length dry gangrene of the fingers, toes, or even the legs, which drop off by the joints; and the patient either recovers slowly by granulation of the stump, or expires worn out during the process of repair. Occasionally, for reasons which are not apparent, these singular effects fail to arise; and some have in consequence been even led to doubt altogether their connection with ergotted rye.——Little is hitherto known of the physiological effects of small medicinal doses when long continued. But they sometimes cause sickness and headache; in females of irritable habit I have known them produce rending pains in the thighs; and recent trials seem to justify the belief, that they tend to arrest hæmorrhagies, especially from the uterus.

The effects of single large doses are quite different. A moderate dose introduced into a vein causes speedy death, with alternating spasm and palsy, sometimes a tendency to coma, and often depressed action or even complete paralysis of the heart. When injected into the cellular tissue, it produces inflammation, an unhealthy discharge, and gradual exhaustion; and when a single large dose is introduced into the stomach, it causes death slowly, with irritation of the alimentary canal, excessive muscular prostration, dulness or obliteration of the senses, and sometimes slight spasms (Wright). It is not in single doses an active poison, three ounces being required to kill a small dog. In man single doses, varying from two to eight drachms, have occasioned vomiting, colic pains, and headache; stupor and delirium have been observed more seldom; and on the other hand it has often been swallowed to a similar amount without any particular effect resulting. Single doses of more moderate extent, such as one or two scruples, are observed to have no great influence of any kind on man in ordinary circumstances. When given however to women in labour, they excite strong and continuous labour-pains, and consequently the speedy expulsion of the child. This singular action has not been generally observed in animals when parturient (Wright); but it has been witnessed by some experimentalists. It has been thought that such doses have also a tendency to excite miscarriage in the human subject, or to destroy the fœtus in the womb; but this opi-

nion is not generally received. They certainly do not cause abor tion in the lower animals (Wright.)

Ergot has been used in medical practice hitherto chiefly on account of its power of promoting uterine contraction in languid natural labour; a property now conceded to it by all the best authorities. The conditions for safety and success are, that labour shall be somewhat advanced and the mouth of the womb moderately dilated;—that there exists no mechanical obstruction to the delivery of the child from disparity of its size to the parts of the mother, from deformity of the pelvis, rigidity of the os uteri, or mal-presentation;—and that the only cause of the slow progress of labour is insufficiency of the uterine contractions in point of force or frequency. Most accoucheurs advise that it be avoided in first pregnancies. It is given to the extent of a scruple or half a drachm in powder or infusion, and repeated once or twice if necessary at intervals of fifteen or thirty minutes. The result commonly is, that in ten, fifteen, or twenty minutes the labour-pains increase in frequency and force, gradually become continuous, and effect the expulsion of the child within an hour. It does not appear that, if prudently given, it ever injures either mother or child. Of 720 cases collected by Villeneuve there were 610 in which it was quite successful, 16 where it succeeded partially, 84 cases of failure, and only 12 where mother or child died. It is of equal service in expelling the retained placenta as in promoting the discharge of the child. It may be also used with advantage to promote the expulsion of a mole, hydatids, a clot of blood, or other uterine contents, when the womb has once begun to act. But doubts exist whether in any of these circumstances it will excite uterine action, if a natural movement towards such action has not commenced.—Ergot has been found serviceable also in various diseases. It has been strongly recommended in hæmorrhagies, especially menorrhagia; in which affection I am able to confirm the favourable representations of prior observers. It seems also sometimes useful in fluor albus and gleet, as well as in chronic dysentery. The emmenagogue virtues ascribed to it by some are of doubtful existence, and have been probably inferred rather from its influence on the womb during labour than from direct observation of its action in amenorrhœa. When given for the purposes last enumerated, it is usually administered in doses of five or six grains four times a-day, or oftener in urgent cases of hæmorrhage.

The formulæ for administering it are simple. It may be given during labour in fine powder with half an ounce of syrup and as much of some aromatic water. Or it may be given in the form of infusion, three ounces of boiling water being used for every scruple of powder, and the strained liquid being aromatised and sweetened to take off its first nauseating impression on the stomach. The fixed oil appeared to Dr Wright to be equally effectual, or even more so, in languid natural labour, in a dose varying from twenty

to fifty drops. It has the advantage of retaining its properties for several years if kept in well-closed bottles excluded from light. It is best given in emulsion with mucilage or syrup and some aromatic water. Externally, Dr Wright found it serviceable as an anodyne in rheumatism and toothache, and as a styptic in hæmorrhage from wounds. If the statements of Bonjean be confirmed, his extract is preferable to the oil. He gives it in doses of three to five grains every ten minutes in obstetric cases, and in hæmorrhagies to the extent of twenty-four grains in the day.

The doses of Ergot are, *Ergota*, E. L. gr. vi. repeatedly in diseases—scr. i. ad scr. ii. repeatedly in slow parturition.

ERYTHRAEA CENTAURIUM, *D.* See *Centaurium.*

EUPHORBIUM. *Concrete resinous juice of undetermined species of Euphorbia, L. W. Spr. (Edin.)—Gum-resin of Euphorbia officinarum (Lond.)—Gum-resin of Euphorbia canariensis (Dub.)—Euphorbium.*

FOR. NAMES.—*Fren.* Euphorbe.—*Ital.* and *Span.* Euforbio.—*Ger.* and *Dut.* Euphorbium.—*Swed.* Prustkåda.—*Dan.* Euphorbium-gummi.—*Arab.* Akal nafsah; Farfiyun.—*Tam.* Shadraykullie paal.

FIGURES of Euphorbia officinarum in Nees von E. 136,—Roque, ii. 84,—Steph. and Ch. iii. 142,—of Euphorbia canariensis in Nees von E. 131, 135.

THIS drug, or rather the plant which produces it, was the Ευφορβιον of the Greek physicians. It is now little used except in veterinary practice.

Natural History.—The numerous species of *Euphorbia*, which belong to Linnæus's class and order *Dodecandria Trigynia*, and give their name to the Natural family *Euphorbiaceæ*, are eminently acrid in every part of their organization. But this property is nowhere so conspicuous as in their milky juice; which, on exuding spontaneously or through incisions from various species, forms gradually a concrete resinous substance possessing intense acridity, and presenting more or less the characters of officinal euphorbium. The source of the officinal variety of euphorbium is not yet accurately determined. Most pharmacologists consider it to be the produce of *Euphorbia officinarum*, which abounds in Northern Africa as well as at the Cape of Good Hope. Some suppose it is obtained from *E. canariensis*, a native of the Canary Isles (Martius). A variety I have repeatedly received from the East Indies, differing from officinal euphorbium in form alone, is believed to be produced by *E. antiquorum*, a common species on the Indian continent and in Arabia-Felix. There is certainly no good authority for the confident references of the London or Dublin College.

The Euphorbium of the English market comes all from Mogadore (Pereira). It is obtained in Morocco, as we are told by Jackson in his account of that country, by making incisions into the fleshy masses composing the plant and allowing the fluid that issues to dry in the sun. It is in roundish or irregular tears, about the

size of a large pea, often hollow, and generally perforated with one or two holes, which are evidently caused by the prickles of the plant. The tears often contain fragments of prickles and other impurities. They are pale grayish-yellow, without lustre, light, brittle, pulverizable, and free of odour. When tasted, little impression is produced at first; but speedily there is excited an intense acrid sensation, very durable, and more quickly removed by fixed oil, than by any other means. The dust powerfully irritates the nostrils and eyes, producing ophthalmia and coryza; so that the process of trituration cannot be safely performed but with great caution.

Chemical History.—Euphorbium melts imperfectly when heated, and burns on live fuel with a bright flame. Water neither dissolves it nor makes an emulsion with it. Alcohol dissolves out a resin possessing the acridity of the crude substance. According to the analyses of Braconnot, of Pelletier, and of Brandes, euphorbium consists essentially of between 37 and 60 per cent of resin, and from 14.4 to 19 of wax,—together with probably a little caoutchouc (Brandes), and a considerable proportion of various salts, particularly the malates of lime and potash. It is therefore not a gum-resin, as the English and Irish Colleges have represented; but it is analogous to the gum-resins, the principle wax taking the place of gum. Its active properties are associated with the resin. Ricord de Madianna has dubiously indicated an acrid principle of peculiar properties in the juice of *E. integrifolia*, a West-Indian species; and this he has called, though prematurely, Euphorbiin.——The East Indian euphorbium differs from the characters just laid down only in being in larger masses, about the size of a filbert or walnut, which are more solid and without holes.

Euphorbium is little subject to adulteration. Its inferior qualities are brownish externally.

Actions and Uses.—It is a powerful irritant, and all its effects on the body are subordinate to that action. It is one of the most energetic of vegetable irritants. Small doses admitted into the stomach cause violent inflammation of the gastro-intestinal mucous membrane; and when introduced into the cellular tissue, it excites fatal diffuse inflammation there. Its powder irritates, inflames, and even ulcerates the skin,—causes obstinate sneezing, discharge of bloody mucus, and great torture, if snuffed up the nostrils,—and excites severe ophthalmia if blown into the eyes. Its effects are so violent that it is now never used except outwardly, and even in this way chiefly in veterinary practice. It has perhaps however been undeservedly neglected of late as a counter-stimulant, and it is thought by some to be a useful addition to the acetic solution of cantharides when used as a substitute for the common blistering plaster. It has consequently been introduced into the Edinburgh formula of the *Acetum cantharidis*; but it is of doubtful advantage, and some think it increases the pain which attends the vesication.

EUGENIA CARYOPHYLLATA, *D.* See *Caryophyllus.*

FARINA, *E. L. D. Flour of the seeds of Triticum vulgare, Villars, Delph.—W. in Hort. Berol.—Spr. (Edin.) Flour of the seeds of Triticum hybernum, L. (Lond. Dub.) Flour.*

For. Names.—*Fren.* Farine.—*Ital.* Farina.—*Span.* Harina.—*Port.* Flor de farinha.—*Ger.* Waizenmehl.—*Tam.* Godumbay mao.

Figures of Triticum vulgare in Nees von E. 31.

Natural History.—Several species of *Triticum* are cultivated in different countries, among which may be mentioned *T. vulgare, Spelta, monococcum, polonicum,* and *durum.* They belong to the Natural family *Graminaceæ.* The *T. vulgare* is the species principally raised in Britain. It has two varieties, *T. vulgare æstivum,* and *T. vulgare hybernum,*—so named, because the former is sown in spring, and the latter in autumn, so that its blade is above ground during the winter. These were considered distinct species by Linnæus, but are now generally referred by botanists to one common stock. Its native country is unknown, but is commonly supposed to have been Central Asia.

Chemical History.—The officinal part of the plant is the flour of the seed. Wheat as sold by the farmer is completely stripped of its husk. In this state it is converted into flour in the grinding-mill, without leaving any residuum in the shape of bran. Wheat flour ought to have a pure white colour. It consists chiefly of starch, gluten, albumen, sugar, gum, a little ligneous fibre, and some moisture. It may be readily resolved into its constituent proximate principles by kneading it in a cloth with cold water. The gluten and a little bran or ligneous fibre remain in the cloth, but detached from one another; the starch, passing through suspended in the water along with a small proportion of finely divided gluten, subsides gradually when the water is allowed to stand at rest for some time; the albumen, sugar and mucilage are dissolved by the water; and the albumen may be separated by concentrating the solution over the vapour-bath, for it then coagulates in flaky particles. Various accounts have been given of the proportion of the several proximate principles in wheat-flour. Vauquelin, who analyzed several samples of French and Odessa wheat, found the starch to fluctuate between 56.5 per cent and 73; the gluten between 7.3 and 14.5; the sugar between 4.2 and 8.5; the gum between 2.8 and 5.8; the bran or lignin between 1.2 and 2.3; and the moisture between 8 and 12. In these analyses the albumen was reckoned along with the gluten; but later researches show an average of 16 or 17 per cent of both principles taken together. The finest qualities of wheat contain the largest proportion of gluten. In the better qualities of the wheat-flour of this city I have obtained 12 or 13 per cent of dry gluten.

The starch of wheat-flour is of fine quality and of greater density than that obtained from most other sources. It constitutes the

common starch of the shops, and is officinal in the British Pharmacopœias under the pharmacuetic name *Amylum*. Wheat gluten is usually assumed as the type or most perfect form of that principle. It abounds more in wheat than in any other kind of grain. In its moist state, as detached from wheat-flour by kneading it with water, it is of a pale dirty gray colour, very adhesive, fibrous in texture, ductile and extremely elastic. It is insoluble in water or ether, cold or warm; but a portion is dissolved by boiling alcohol, which on cooling deposits what some chemists consider to be vegetable caseïn, whilst true gluten remains dissolved in the spirit. The portion not dissolved is regarded by some as vegetable fibrine. It is also soluble in acetic acid. When kept moist it soon becomes acid, and afterwards putrefies, exhaling the odour of decaying animal matter. When dried, it loses about half its weight, and becomes a hard, brittle, grayish-green substance of a glistening appearance and resinous fracture. It does not again recover its tenacity and viscidity on being put into water. It is a highly azotiferous principle, its composition being very nearly that of the great animal alimentary principles, fibrin, casein, and albumen. The other proximate principles in wheat-flour do not present any remarkable peculiarity.

When wheat-flour is heated with water to a temperature somewhat under 212°, so that its starch undergoes solution, an adhesive paste is formed, the superior tenacity of which over the paste made with other kinds of flour depends on its large proportion of gluten. When it is kneaded into dough and mixed with yeast, fermentation takes place; the carbonic acid, which is disengaged, distends the dough into a cellular mass; and some alcohol is at the same time formed. These changes, which constitute what is sometimes called the panary fermentation, are effected at the expense of the sugar in the flour. They are essential to the conversion of flour into bread. Bread is made by heating the dough which has undergone the changes in question. The insoluble starch is thus partly converted into soluble amidin. No other flour but that of wheat will yield an article of the same qualities with wheat bread; because the presence of the extensile gluten is necessary for perfecting the *raising* of bread,—that is, for giving it a vesicular structure.

Adulterations.—Wheat-flour is subject to numerous adulterations, which it would be tedious to enumerate. The most material of them are fixed earthy substances, moisture, and other farinaceous matters, especially potato-starch. The first adulteration is detected by incinerating the flour; the second by ascertaining that it does not lose more than twelve per cent of its weight when heated over the vapour-bath; and the third by kneading the flour with a thin stream of water over a cloth filter, allowing the starch to subside in the filtered water, triturating the lower stratum with water in a mortar, and testing this with iodine, which strikes a blue colour if potato-starch be present, and merely a yellow or red colour if the flour be pure. Potato-starch may also be discovered with the aid

of the microscope by means of the comparatively large size of its globules.

Actions and Uses.—Wheat is generally thought to be the most nutritive of all the grains, because it contains the largest proportion of the azotized principle gluten. In the form of bread it is the most digestible of all farinaceous articles of food. Its strictly medicinal uses are in the shape of flour for yielding starch, in the form of bread as an adhesive excipient for making pills, and in the state of toast for making the familiar diet-drink toast-water.

FERRI FILUM, *E. D.* *Iron wire.*

FERRI RAMENTA, *L.* *Iron-filings.*

FERRUM, *E. L. D.* *Iron.*

FOR. NAMES.—*Fren.* Fer.—*Ital.* Ferro - *Span.* Hierro.—*Port.* Ferro.—*Ger.* Eisen.—*Dut.* Ijzen.—*Swed.* and *Dan.* Iern.—*Russ.* Gelezo.—*Arab.* Hedeed. *Pers.* Ahun.—*Tam.* Erumboo.

IRON is the most generally diffused of all the metals. Few minerals, and scarcely any of those which form a material part of the crust of the earth, are entirely without it; and it is also generally met with in animal and vegetable substances. It occurs native in meteoric stones, and much more generally mineralized by oxygen or by sulphur. Its most common ores are the sulphuret or iron-pyrites, the sesquioxide composing the principal part of the red and black-hæmatites, a compound of the protoxide and sesquioxide constituting the magnetic-iron-ores, and a variable mixture or combination of protocarbonate and sesquioxide with silica and alumina forming clay-ironstone. In this country iron is obtained chiefly from the last of these by first roasting it,—then heating it with coal and lime so as to obtain cast-iron,—and lastly, exposing it in a fused state to a current of air playing on its surface and then forging it, by which means most of its impurities are removed, and it is converted into soft or malleable iron. There are many varieties of iron in commerce, two of which are used for preparing the medicinal compounds of this metal, namely, iron-wire and iron-filings. The latter form is apt to contain extraneous substances introduced accidentally, which cannot be easily removed; the former, besides being free of this source of impurity, is also commonly of finer quality from the first, and should therefore be preferred for pharmaceutic purposes.

Chemical History.—Iron has a bluish-gray colour, a granular or irregularly foliaceous fracture, and much brilliancy, which it preserves long in dry air, but quickly loses under the contact of air and moisture together. It has a peculiar taste and odour. Its density when pure varies from 7.6 to 7.84, according to its form. It is very ductile, considerably malleable, and the most tenacious of metals. It is fused with difficulty. It burns readily in oxygen gas, and even in the air when struck in particles from a mass at a white heat. It unites with oxygen, forming three oxides, a protoxide, a

sesquioxide, and a compound of these. It also unites readily with sulphur. Iodine combines rapidly with it at ordinary temperatures if moisture be also present; and the moisture of the atmosphere is sufficient for the purpose. It is promptly oxidated and dissolved by the acids, forming salts, which are mostly soluble, and in general crystallizable. The compounds used in medicine are the sesquioxide, its hydrate, the black oxide, the sulphuret, sesquichloride, and iodide, the cyanide of the sesquicyanide (Prussian blue), the carbonate, sulphate, and acetate, the chloride of iron and ammonia, and the tartrate of iron and potash. Some newer preparations, not yet in the Pharmacopœias, will be noticed in the Supplement.

Actions and Uses.—Iron in its metallic state has been used both in regular and domestic practice as a tonic, in dyspepsia and in debilitating diseases generally. It has no action, however, on the animal body in its metallic form. When swallowed in this state it becomes oxidated, apparently at the expense of the water in the stomach; for eructations take place, which have a disagreeable chalybeate taste and an odour of hydrogen. The dose usually given is from five to ten grains, and the form that of fine iron-filings.

When oxidated, iron in its various forms is a tonic and an astringent. Some of its soluble preparations are irritant, but scarcely to such a degree as to be generally classed with poisons. When taken for some time in small doses as a tonic, iron, whatever be its chemical form, strengthens and also sometimes accelerates the pulse, improves digestion, heightens the complexion, and tends to increase the secretions. In the course of its action it appears to enter the blood; for it has been detected in the urine. But no good experiments have yet been made to prove the generally-received doctrine, that the iron of the blood is increased during a chalybeate course. The blood, however, becomes more florid. When pushed too far, or administered to persons prone to determination of blood towards the head, or affected with habitual constipation, chalybeates often occasion a sense of fulness in the head, headache, giddiness, distension of the limbs, and other uneasy sensations.

The preparations of iron are used in intermittent fever for arresting the paroxysm, in passive hemorrhagies, in chronic diarrhœa and the chronic stage of dysentery, in enlargement of the liver and spleen, especially arising from tedious or repeated attacks of ague, in epilepsy and diseases allied to it, in neuralgia of all sorts, but particularly tic douloureux and periodic neuralgia, in dyspepsia depending on loss of tone or defective secretion, not upon irritability of the stomach, in dropsy, cancer, chlorosis, scrofula, and diseases of the urinary organs connected with debility. In short, whenever tonic treatment is considered advisable, the preparations of iron are in constant use. Of the diseases now mentioned, those in which the beneficial action of chalybeates is most characteristically and frequently remarked are chronic dysentery, enlargement of the liver and spleen, neuralgia, dyspepsia, and chlorosis. In enlarge-

ment of the liver or spleen, more especially when produced by the severe intermittent and remittent fevers of hot climates, the effect of a long-continued course of chalybeates is sometimes remarkable. Their power of arresting neuralgia, when this depends on derangement of the digestive organs, and particularly where it puts on the periodic form, is scarcely less to be depended on. In dyspepsia and chlorosis their effects are also often striking, above all when the iron is administered in the form of mineral water.

Much discrepancy of opinion prevails as to the most efficacious form for administering iron as a remedy in these various diseases; and a great variety of preparations of this metal are in consequence to be found in the European Pharmacopœias. It is much to be desired that accurate inquiries were made as to their respective qualities. That the officinal preparations are unnecessarily numerous, no one can doubt who looks to the extreme simplicity of the action of chalybeate remedies. A considerable difference will probably be found to exist between those where the iron is in the form of protoxide, and those in which it is present as a sesquioxide; and the former are generally, and perhaps correctly, considered the more active.

FERRI ACETAS, *D.* *Solution of Acetate of Iron.*

PROCESS, *Dub.* Take of
Carbonate of iron, one part;
Acetic acid, six parts.
Digest for three days, and filter.

FERRI ACETATIS TINCTURA, D.

PROCESS, *Dub.* Take of
Acetate of potash, two parts;
Sulphate of iron, one part;
Rectified spirit, twenty-six parts.
Rub the salts in an earthen-ware mortar into a uniform mass; which is to be dried with a gentle heat and triturated with the spirit. Digest for seven days in a well-closed bottle, with occasional agitation; let it rest, pour off the clear liquid, and keep it in well-closed bottles.

FERRI ACETATIS TINCTURA CUM ALCOHOL, D.

PROCESS, *Dub.* Take of
Acetate of potash and
Sulphate of iron, of each an ounce;
Alcohol, thirty-two fluidounces.
Proceed as for the last preparation; but digest for twenty-four hours only.

FOR. NAMES.—*Fren.* Acetate de fer.—*Ital.* Acetato di ferro.—*Ger.* Essigsaures eisenoxyd.

Chemical History.—ACETATE OF PROTOXIDE OF IRON may be obtained in small, green, prismatic crystals, which readily undergo decomposition if exposed to the air. None however of the preparations mentioned above is a pure protacetate. The first of them is a solution in acetic acid of sesquioxide of iron; of which compound the carbonate of iron of the Dublin Pharmacopœia mainly consists. In the second and third preparations the acetate of iron is formed by double decomposition from the acetate of potash and sulphate of iron; and the acetate of iron is dissolved in the one case by rectified spirit of the density 840, and in the other by a stronger spirit of the density 810, by either of which the sulphate of potash

is left undissolved. These however are somewhat unscientific preparations for a modern Pharmacopœia. One of them must contain acetate of potash besides acetate of iron, because a large excess of the former salt is used,—the decomposing proportions of acetate of potash and sulphate of iron being, not two to one as adopted in the formula, but 117 to 130 nearly. Besides, each preparation contains both acetates of iron; for the protoxide must be partially converted into the sesquioxide by exposure to air during the trituration and subsequent digestion. It is probable that acetate of iron is an efficacious and convenient mode of administering that metal. But there is no evidence of its superiority over the older and more familiar chalybeate salts; and the Dublin College ought therefore to have paused before adding to the number of a tribe of compounds already numerous enough. At all events there is surely no occasion for three preparations of the acetate, and still less for two spirituous solutions differing essentially from one another only in strength. It appears that when equal parts of acetate of potash and sulphate of iron are used, a permanent solution can be obtained only with the stronger spirit of the density 810; and that if common rectified spirit be used the solution is not permanent unless only half as much sulphate of iron be employed.

Actions and Uses.—The acetate of iron possesses the properties of chalybeate preparations generally, as they are laid down under the head of iron (see *Ferri filum*). It has scarcely been used in this quarter, but is a favourite chalybeate with many practitioners in Ireland. It is an old preparation revived, having been formerly known by the name of *Extractum martis aceticum*, or *Acetum martiale.* Dr Percival, who was much attached to it, used to prescribe it in asses' milk.

The forms of the acetate contained in the Dublin Pharmacopœia are given in the following doses: *Ferri acetas*, D., min. v. ad xx. —*Ferri acetatis tinctura,* D., min. xx. ad fl. dr. i.—*Ferri acetatis tinctura cum alcohol,* D., min. xx. ad fl. dr. i.

FERRI AMMONIO-CHLORIDUM, *L.* *A substance of a doubtful nature, probably a mere mixture of salts.*

TESTS, *Lond.* Entirely soluble in water and proof-spirit; potash throws down sesquioxide of iron from the solution, and if added in excess disengages ammonia.

PROCESS, *Lond.* Take of
Sesquioxide of iron, three ounces;
Hydrochloric acid, half a pint;
Hydrochlorate of ammonia, two pounds and a half;
Distilled water, three pints;

Digest the acid and sesquioxide in a proper vessel at a sand-bath heat for two hours; then add the hydrochlorate of ammonia previously dissolved in the water; filter, evaporate to dryness, and pulverize the residue.

TINCTURA FERRI AMMONIO-CHLORIDI, L.

PROCESS, *Lond.* Dissolve four ounces of Ammonio-chloride of iron in a pint of proof-spirit, and filter.

FOR. NAMES.—*Fren.* Fleurs ammoniacales martiales; Chlorure de fer ammonique.—*Ger.* Salzaures eisenoxyd-ammoniaque.

THE AMMONIATED CHLORIDE OF IRON was discovered in the fourteenth century by Basil Valentin.

Chemical History.—When muriate of iron and muriate of ammonia are subjected together to a strong heat they are sublimed in irregular proportion to one another, and a yellow salt is obtained, which was long known by the name of *Flores martiales.* This substance at one time had a place in all the British Pharmacopœias. The Colleges of Edinburgh and Dublin have in their last editions rejected it entirely. The College of London, following the example of the Swedish and Parisian Pharmacopœias, has abandoned the process of sublimation as producing a substance of irregular composition, and directs that a solution of the two salts in a given proportion shall be simply evaporated to dryness. The product is in all probability nothing more than a mere mixture of the two hydrochlorates. Nor is there any good authority for the designation given to it by the London College, which implies that the substance obtained is a regular double chloride or hydrochlorate. That it is not so will appear from an observation of Berzelius, who found, that on repeatedly evaporating and crystallizing a solution of muriate of ammonia and muriate of iron, crystals of pure sal-ammoniac are at last obtained Hensler however says a permanent double salt may be made by evaporating to dryness in the sun a mixture of ten parts of sal ammoniac and fifteen parts of a solution of one part of sesquioxide of iron dissolved in four of muriatic acid of the density 1120.

The ammonio-chloride of iron is a yellow powder, which is soluble entirely both in water and weak spirit. It has a strong chalybeate taste. Its solution, when treated with ammonia or potash, deposites yellow flakes of sesquioxide of iron; and potash also disengages ammonia. These characters distinguish it from other chalybeate preparations. It contains, according to Mr Phillips, 85 per cent of hydrochlorate of ammonia, and 15 of muriate or sesquichloride of iron.

Adulterations.—The tests of the London College, which are the characters just described, ascertain the nature of the substance, but do not detect impurities. It might have been well that some means had been added for testing the chalybeate strength of the preparation.

Actions and Uses.—Important properties have been ascribed to the *Flores martiales* as a tonic, astringent, diuretic, laxative, emmenagogue, and anthelmintic. The information hitherto possessed, however, on the subject is scanty and vague, but it is probable that the qualities of the ferruginous salt are modified by those of the sal-ammoniac, which is itself possessed of some energy as a remedy. The compound has fallen into disuse in most countries. The solid ammonio-chloride may be given in the form of pill made with any of the bitter extracts and syrup; but astringent vegetable substances must be avoided, as they decompose the salt of iron.

The doses of its preparations are—*Ferri ammonio-chloridum*, gr. iii. ad gr. x. *Ferri ammonio-chloridi tinctura*, min. x. ad min. xxx.

FERRI CARBONAS, *D.* See *Ferri oxidum rubrum.*

FERRI CARBONAS SACCHARATUM, *E.* *Carbonate of protoxide of iron in an undetermined state of combination with sugar and sesquioxide of iron. Saccharine Carbonate of iron.*

TESTS, *Edin.* Colour grayish green: easily soluble in muriatic acid, with brisk effervescence.

PROCESS, *Edin.* Take of
Sulphate of iron, four ounces;
Carbonate of soda, five ounces;
Pure sugar, two ounces;
Water, four pints;
Dissolve the sulphate and carbonate each in two pints of the water; add the solutions and mix them; collect the precipitate on a cloth filter, and immediately wash it with cold water, squeeze out as much of the water as possible, and without delay, triturate the pulp which remains with the sugar previously in fine powder. Dry the mixture at a temperature not much above 120°.

MISTURA FERRI COMPOSITA, L. D.

PROCESS, *Lond. Dub.* Take of
Powder of myrrh two (one, D.) drms.;
Carbonate of potash, one drachm (twenty-five grains, D.);
Rose-water, eighteen fluidounces (seven ounces and a half, D.);
Sulphate of iron, two scruples and a half (one scruple, D.);
Spirit of nutmeg, one (half, D.) fluidounce;
Pure sugar, two drachms (one, D.);
Beat the myrrh with the spirit and carbonate, adding first the rose-water and sugar, and then the sulphate of iron. Put the mixture immediately into a well-closed bottle.

PILULAE FERRI CARBONATIS, E.

PROCESS, *Edin.* Take of
Saccharine carbonate of iron, four parts;
Red-rose conserve, one part.
Beat them into a proper mass to be divided into five-grain pills.

PILULAE FERRI COMPOSITAE, L. D.

PROCESS, *Lond. Dub.* Take of
Powder of myrrh, two drachms;
Carbonate of soda,
Sulphate of iron, and
Treacle (brown sugar, D.), of each one drachm;
Beat the myrrh and carbonate together, then beat the mixture with the sulphate of iron, and lastly beat the whole into a proper mass in a heated mortar (with a sufficiency of treacle, D.)

Chemical History.—WHEN green vitriol, the sulphate of protoxide of iron, is mixed in a state of cold solution with carbonate of soda, double decomposition ensues; sulphate of soda remains in solution; and a pale bluish-green carbonate of protoxide of iron falls down in the form of a loose bulky powder. The precipitate undergoes little alteration for a long time, if kept well covered with water. But if the water be separated by filtration, the surface of the damp carbonate quickly becomes reddish-yellow under exposure to the atmosphere; and if it be dried, with or without heat, the whole mass acquires the same hue. This change of colour is accompanied by important changes in constitution. The carbonic acid escapes, and at the same time the protoxide passes to the state of sesquioxide,—which is less easily soluble in acids, and less active as a medicinal agent. At one time it was supposed that the car-

bonic acid is in part retained. But the proportion retained in the dry powder is in all circumstances small, and amounts to a mere trace only if the solutions of sulphate of iron and carbonate of soda be used cold. In short, the preparation, as obtained in the way now mentioned, is not a carbonate, as it was once held to be by the Colleges, but is the sesquioxide, and is accordingly now termed so by the London College (See *Ferri oxidum rubrum*). There is no carbonate of the sesquioxide of iron.

A general desire had long been felt among practitioners to improve this preparation by maintaining it in the state of protoxide. Dr Clark of Aberdeen proposed, that for this end the carbonate should be formed without heat, and that it should not be dried at all, but merely squeezed and made at once into an electuary with sugar and aromatics. This process was the more admissible, that the so-called carbonate of iron, obtained by drying the precipitate, has been seldom given in any other form than as an electuary. It now appears however that Dr Clark's formula secures more important advantages than he contemplated. Dr Clark seems to have intended to prevent the change from protoxide to sesquioxide by forming the material into a firm pulp, impervious to the air. It occurred to me however to observe that the electuary might be dried up completely without parting with its carbonic acid; and not long afterwards, Klauer, a German chemist, discovered that sugar has the property of preventing the protoxide of iron from attracting oxygen from the air, even when the mixture is thoroughly dried with the aid of a gentle heat. The Edinburgh College has taken advantage of this discovery, and has adopted the Saccharine carbonate of iron into its Pharmacopœia. In the process, as soon as the carbonate of iron is deprived of most of the water by filtration and pressure, it is mixed with the sugar to prevent farther oxidation; after which the mixture may be safely dried either spontaneously or at a gentle heat between 120° and 140°.

The principle on which this preparation is formed is not altogether new to the Pharmacopœias. For the *Mistura ferri composita*, L. D. and *Pilula ferri composita*, L. D., long known and highly esteemed by many under their trite names of Griffith's mixture and Griffith's pill, are essentially saccharine carbonates of iron, with various additions. They have been generally considered unchemical, because the alkaline carbonate decomposes the sulphate of iron in the formula; but the sugar preserves the greater part of the carbonate from decomposition. The principle of these preparations however was unknown prior to the researches of Klauer. It must also be observed that in the *Mistura* the preservative power of the sugar is impaired by too great dilution.

The action of the sugar in the saccharine carbonate of iron is somewhat obscure. Klauer supposes that a regular compound is formed between the sugar and the protoxide of iron. But the protoxide is combined with carbonic acid. The whole iron how-

ever is never preserved in the state of carbonate of the protoxide. Klauer found his compound to contain twenty per cent of sesquioxide and eighty of protoxide; and I have never observed the carbonic acid to exceed two-thirds of what ought to be present, were the whole iron in the state of carbonate.——It has been alleged that the formation of sesquioxide may be prevented altogether by dissolving the carbonate of soda and sulphate of iron in water sweetened with an ounce of sugar for every pound, washing the precipitate with the same solution, adding honey, and evaporating with a gentle heat to the proper consistence for pills (Vallet).

In preparing the saccharine carbonate of iron the solutions of the salts must not be used hot, otherwise much carbonic acid is disengaged. I have not found any advantage in using more sugar than in the formula; and with less there is a manifest diminution in the retained carbonic acid. When well made, the preparation has a dirty bluish-green or grayish-blue colour, which is permanent, at least for a long time, under exposure to the air. It possesses a sweet and strongly chalybeate taste, and dissolves entirely in muriatic acid with brisk effervescence. Fifty grains ought to yield 7·5 cubic inches of gas when decomposed by an acid.

Actions and Uses.—The saccharine carbonate of iron is a powerful and excellent chalybeate. Dr Clark found it to surpass greatly the sesquioxide in energy,—as might be expected from its nature and solubility in acids. The sesquioxide in the form of electuary is often given in the dose of several drachms or even ounces at a time; while fifteen grains of the carbonate have occasioned sickness, and ten grains twice a-day have in my observation produced headache and a sense of fulness in the head. The sesquioxide too alters but little the character of the alvine discharges, while the saccharine carbonate, like all other active chalybeates, renders them greenish-black. The new preparation has proved of service in neuralgia and other diseases in which the sesquioxide had been currently used; and I have found it an effectual, as well as convenient, chalybeate tonic.

The officinal preparations of the saccharine carbonate, with their doses are *Ferri carbonas saccharatum*, E. gr. v. ad gr. xxx.—*Mistura ferri composita*, L. D. fl. unc. i. ad fl. unc. ii.—*Pilula ferri carbonatis*, E. gr. v. ad gr. xxx.—*Pilula ferri composita*, L. D. gr. x. ad gr. xx. The Edinburgh saccharine carbonate is best given in the form of pill.

FERRI CYANURETUM, *D.* FERRI PERCYANIDUM *L.* *Ferrosesquicyanide of iron.* *Prussian-blue.*

FOR. NAMES.—*Fren.* Bleu de Prusse.—*Ital.* Azzurro di Berlina.—*Ger.* Berlinerblau.—*Russ.* Berlinskaia lazur.

PRUSSIAN-BLUE, the trite name of this complex substance, has been introduced into the Dublin and London Pharmacopœias as

the material from which bicyanide of mercury is made; and this again has been admitted solely for the preparation of hydrocyanic acid. Since this acid however may be better prepared from other materials, both compounds may be dispensed with.

•*Chemical History.*—Pure Prussian-blue is best obtained by precipitating a solution of ferrocyanate of potash with sulphate of the sesquioxide of iron acidulated with sulphuric acid, and washing the blue precipitate with very weak sulphuric acid. The Prussian-blue of commerce is obtained by fusing animal matters with carbonate of potash so as to form cyanide of potassium, and treating the solution of the product with alum and green vitriol. The greenish precipitate thus produced acquires a lively blue tint under exposure to the air. In this state Prussian-blue is impure; for it contains alumina, sesquioxide of iron, and ferrocyanide of potassium. It is comparatively ill fitted for preparing bicyanide of mercury; but if purified by digestion in sulphuric acid considerably diluted, a very pure preparation is obtained, which will yield a pure bicyanide.

Prussian-blue is of a rich dark blue colour, tasteless, insoluble, and inert in relation to the animal economy. Diluted acids do not act on it. The strong acids decompose it, with a variety of phenomena. The alkalis also decompose it, forming ferrocyanates. Chemists are not agreed as to its precise nature. But the opinion of Berzelius is most generally adopted, according to which it is a compound of three equivalents of cyanide of iron, and two equivalents of the sesquicyanide of the same metal ($3\ Fe\ Cy + 2\ Fe^2\ Cy^3$).

Uses.—Although it is understood to have been introduced into the Materia Medica of this country merely for preparing the bicyanide of mercury, yet it has also been used medicinally. In small doses of a single grain or a little more it has been accounted a good remedy in intermittent and remittent fever by some physicians of Germany and the United States. In doses somewhat larger it has also been used as an antispasmodic calmative in epilepsy, hysteria, and chorea. And as an astringent it has been commended in chronic dysentery. Coulon however, in his inquiries into the action of the compounds of cyanogen, found it to be inert as a physiological agent; and one cannot easily see what therapeutic action it can exert in the small doses generally given, considering that it is extremely insoluble in all such fluids as those which it encounters in the alimentary canal.

FERRI IODIDI SYRUPUS, *E.* *Solution of Iodide of Iron in syrup. Syrup of iodide of iron.*

TESTS, *Edin.* Colourless or pale greenish-yellow; transparent; without sediment, even when exposed to the air.

PROCESS, *Edin.* Take of
Iodine (dry), 200 grains;
Fine iron-wire, recently cleaned, 100 grains;
White-sugar in powder, four ounces and a-half;
Distilled water, six fluidounces.
Boil the iodine, iron, and water toge-

ther in a glass mattrass, at first gently to avoid the expulsion of iodine-vapour, afterwards briskly, till about two fluidounces remain. Filter this quickly, while hot, into a mattrass containing the sugar; dissolve the sugar with a gentle heat, and add distilled water to make up six fluidounces.—Twelve minims contain one grain of iodide of iron.

FERRI IODIDUM, *E. L.* *Protiodide of Iron.*

Tests, *Edin.* Entirely soluble in water, or nearly so; forming a pale-green solution.

Tests, *Lond.* It gives off violet vapours when heated, leaving sesquioxide of iron; entirely soluble when recently made; but this solution in an ill-closed vessel quickly deposites sesquioxide of iron, and can be kept clear only in a vessel well-closed and containing an iron-wire.

Process, *Edin.* Take any convenient quantity of iodine, iron-wire, and distilled water in the proportions for making syrup of iodide of iron. Proceed as directed for that process; but before filtering the solution, concentrate it to one-sixth of its volume, without removing the excess of iron-wire. Put the filtered liquor quickly into an evaporating basin, with twelve times its weight of quicklime around the basin, in some convenient apparatus in which it may be shut up accurately in a small space not communicating with the general atmosphere. Heat the whole apparatus in a hot-air-press or otherwise, until the water be entirely evaporated; and preserve the dry iodide in small well-closed bottles.

Process, *Lond.* Take of
Iodine, six ounces;
Iron-filings, two ounces;
Distilled water, four pints and a half.
Mix the iodine with four pints of the water; add the iron; heat the whole in a sand-bath till the solution becomes pale-green; pour off the liquid, wash the residue with half a pint of boiling distilled water, add this to the other liquid, filter the whole, and evaporate it to dryness in an iron vessel at a temperature not exceeding 212°. Preserve the product in close vessels excluded from the light.

For. Names.—*Fren.* Iodure de Fer.—*Ger.* Eiseniodür.—*Russ.* Iodistoe gelezo.

For the introduction of the Iodide of Iron into medical practice we are indebted to the researches of Dr Thomson of University College London. Since the publication of his treatise, it has come into general use in this country. Of the preparations suggested by Dr Thomson the London College has adopted only the dry iodide of iron. In the first edition of the English Pharmacopœia of the Edinburgh College a solution in water was also admitted; but this has been abandoned in the later edition for one of the same strength, in which the menstruum is concentrated syrup.

Chemical History.—When iodine and iron are boiled together in water, the iron is rapidly oxidated at the expence of the water, the hydrogen of which combines at the same time with the iodine to form hydriodic acid. As soon as the whole iodine has undergone this change and united with the oxide of iron, the fluid, from being dark reddish-brown, becomes clearer, with some yellow sesquioxide of iron floating in it; and if it be promptly filtered and with little exposure to the air, a fluid is obtained either of a pale greenish tint, or, as I have generally observed, quite colourless at first. Boiling, however, is not essential to the formation of the solution, for it may be accomplished in a very little more time by agitating the due proportions of iron and iodine in a bottle

with cold water. The mixture becomes spontaneously warm during the process. The result of this combination is a solution of hydriodate of protoxide of iron, or according to the doctrine prevalent among some chemists, a solution of protiodide of iron. In this state the preparation is believed to be most fit for medicinal use. But, like the compounds in which iron is united with one equivalent of oxygen or chlorine, the solution of the protiodide is exceedingly apt to undergo decomposition by exposure to air, and more especially to air and light together. Even in filtering a solution some decomposition will take place, unless pains be taken to prevent free access of air; and if it be afterwards left exposed, a material change will take place in the course of a few hours. This consists in the oxide of iron passing to the state of sesquioxide, and being in part deposited, while the salt in solution becomes the hydriodate of the sesquioxide, or the sesquiodide of iron. It is found that decomposition is best prevented by keeping an iron wire in the solution and preserving the bottle carefully corked and in a dark place. I have thus kept it with scarcely any change for eighteen months. A perfectly neutral iodide is also to be got by triturating 162 parts of crystallised protosulphate of iron with 207 parts of iodide of potassium, and taking up the iodide of iron with alcohol, which separates sulphate of potash [Calloud.]——In consequence of this proneness to decomposition, it is not very easy to obtain from the solution a pure iodide of iron in the solid state. It is best prepared, as suggested by the Messrs Smith of this city, and recommended in the Edinburgh Pharmacopœia, by evaporating the solution to a state of considerable concentration in contact with iron, filtering the product while hot, instantly inclosing it in a confined space, with quicklime around the basin, and heating the whole apparatus in a hot air press or other convenient method, till a dry salt be obtained by means of the lime absorbing the water as it undergoes evaporation. It is impossible to obtain the protiodide free of sesquioxide of iron by the London formula. When carefully prepared by the Edinburgh formula, and well kept, it has a dark grayish-black metallic appearance and irregularly foliated texture, not unlike iodine itself, and dissolves with scarcely any residue in distilled water, forming a pale yellowish-green solution. It deliquesces rapidly if exposed to the air, and likewise undergoes the changes in constitution mentioned above; so that sesquioxide of iron separates, and a dark orange-red solution is formed, containing sesquiodide of iron and probably also some protiodide. When exposed to heat, the protiodide parts with iodine in violet fumes, and at length nothing is left but sesquioxide of iron. It has a strong styptic chalybeate taste. The anhydrous salt consists of an equivalent of each constituent, and consequently of 126.3 parts of iodine and 28 of iron. The salt of the shops contains variable proportions of combined water, which it is difficult to drive off without decomposing it and expelling some iodine. By conduct-

ing the evaporation of the solution over quicklime without artificial heat, I have repeatedly obtained large tabular crystals of a pale yellowish-green colour, and perfectly transparent. The crystallized salt contains, according to Mr Phillips, five equivalents, or 45 parts, of water ($Fe\ I + 5\ HO$).

Sugar, which possesses the property of preventing the peroxidation of some salts of the protoxide of iron, (see *Ferri carbonas*,) was found by M. Frederking of Riga, to have a similar protective action on a newly made solution of protiodide of iron. This fact has been amply confirmed by Dr Thomson and others, and has been taken advantage of by the Edinburgh College for preparing the *Syrupus iodidi ferri*. In this process the solution, when just completed, is filtered at once into pounded sugar, and immediately converted into a concentrated syrup. I find that this preparation scarcely undergoes any change in appearance for some days, even when exposed to the air, but afterwards slowly becomes pale yellowish, yet without depositing any oxide in three months. A syrup with a larger proportion of the iodide becomes brown, also without the separation of any oxide. When dried up either spontaneously or in the vapour-bath, the saccharine iodide is not entirely soluble again, but leaves a little sesquioxide of iron. I apprehend the change of colour in the syrup under exposure, without any precipitate forming, is owing to some sesquioxide of iron being produced, but remaining in a state of union with the protiodide and sugar. This syrup is the best fluid form yet proposed for administering the iodide of iron. Twelve minims, or fifteen drops, contain a grain of the salt. It must not be diluted long before being used, because in that case the protective power of the sugar is greatly lessened.

Adulterations.—The iodide of iron and its syrup can scarcely be said to be subject to express adulteration; but the former is generally of inferior quality, because imperfectly made at first, or not preserved with care. All specimens are inferior which do not present the characters mentioned by the Edinburgh and London Colleges. The syrup ought to be nearly colourless, or pale yellowish-green, and without sediment; and the solid salt should form with boiling water a solution of a pale green hue. It is important to observe, that the syrup may be defective in strength unless allowance be made for the water which commercial iodine sometimes contains in large proportion (see *Iodineum*).

Actions and Uses.—The iodide of iron was proposed by Dr Thomson as being likely, by reason of its composition, to combine in an eminent degree the properties of a tonic and deobstruent. In its physiological action however it seems to approach the preparations of iron fully more than those of iodine. In small doses it is laxative and diuretic, and elevates somewhat the animal temperature and insensible transpiration (Thomson). In large doses it produces, when swallowed or injected into a vein, effects similar in kind, and somewhat superior in degree, to those of the sulphate of iron, and

not the effects either of iodine or iodide of potassium (Cogswell). It is evidently absorbed when used medicinally; for soon after being swallowed both iodine and iron may be found in the urine.——It has been employed as a tonic deobstruent in scrofula, chlorosis, pseudosyphilis, chronic cutaneous diseases, amenorrhœa, and chronic rheumatism; and from the evidence furnished by Dr Thomson and others, it seems to be an important remedy in several of these diseases, more especially scrofula, chlorosis, and chronic rheumatism. But doubts may be reasonably entertained whether the iodine has much to do with its therapeutic action; and the opinions of late observers incline to the conclusion, that its effects are owing to its composition as a salt of iron rather than to its being a compound of iodine. As iodide of iron is quickly decomposed by a great variety of substances, it is best to administer the syrup in a state of simple solution in water; and as dilution impairs the preservative powers of the sugar, the mixture should be made by the patient himself immediately before swallowing it. The officinal syrup of the Edinburgh College may be thus given several times a-day in doses varying from fifteen to sixty drops. Larger doses are apt to occasion sickness and even vomiting. The simple solution of the iodide in water, is now abandoned entirely in favour of the syrup. The solid iodide of iron appears now a useless incumbrance of the Pharmacopœias. It is troublesome to make, and still more so to preserve; and is put to no use except to form pills. These however are better prepared by the following process. Agitate 127 grains of iodine, half an ounce of coarse iron-wire, and 75 minims of distilled water in a strong stoppered ounce phial until the froth becomes white. Pour the fluid upon two drachms of powdered sugar in a mortar, triturate briskly and add gradually half an ounce of liquorice powder, a drachm and a half of powdered gum, and a drachm of flour. Divide the mass into 144 pills, each of which contains about a grain of iodide of iron (Leslie).

The preparations hitherto in use are merely *Ferri iodidum*, E. L. gr. i. ad gr. v. *Ferri iodidi syrupus*, E. gtt. xv. ad fl. dr. i. several times daily.

FERRI MISTURA AROMATICA, *D.* *Solution of an undetermined salt of iron, with aromatics, in an infusion of cinchona-bark.*

PROCESS, *Dub.* Take of
Crown-bark, in coarse powder, one oz.
Calumba, sliced, three drachms;
Cloves, bruised, two drachms;
Iron-filings, half an ounce.
Digest for three days, agitating occasionally in a close vessel, with as much peppermint-water as will yield twelve ounces of filtered fluid. Then add of
compound tincture of cardamom, three ounces;
Tincture of orange, three drachms.

THIS preparation ought to have been comprehended under those of cinchona rather than those of iron. Only a small quantity of iron is dissolved. Its solution is owing to oxidation of the filings

and union of the oxide with some of the numerous organic principles which are taken up by the menstruum. The preparation has a greenish-black colour owing to the presence of tannate of iron. It is unchemical, and unworthy of a place in any Pharmacopœia.

It is a tonic, stimulant, and carminative mixture, whose properties are owing to its bitter and aromatic ingredients rather than to its chalybeate impregnation. Its doses are fl. unc. i. ad fl. unc. ii.

FERRI MURIATIS TINCTURA, *E. D.* TINCTURA FERRI SESQUICHLORIDI, *L.* *Spirituous solution of the sesquichloride, or hydrochlorate of the sesquioxide, of iron. Tincture of Iron.*

PROCESS, *Edin. Lond.* Take of
Red oxide (sesquioxide, *L.*) of iron, six ounces;
Muriatic acid (hydrochloric acid, *L.*) one pint;
Rectified spirit, three pints.
Digest the oxide in the acid for three days in a glass vessel, with occasional agitation; then add the spirit and filter.

PROCESS, *Dub.* Take of
Rust of iron, one part;
Muriatic acid, and
Rectified spirit, six parts of each;
Mix the Rust and acid in a glass vessel, and shake them occasionally for three days; then, after the impurities subside, pour off the solution, evaporate slowly down to a third, and add the spirit.

FOR. NAMES.—*Fren.* Teinture de chlorure de fer.—*Ital.* Tintura de muriato di ferro.—*Ger.* Eisenchlorid.

Chemical History.—IRON unites with chlorine in two proportions, forming a chloride and sesquichloride. The former is a hard, white, shining, scaly substance, exceedingly deliquescent, fusible at a red heat, and volatile at a temperature considerably higher. The sesquichloride forms brown, metallic-like scales, which also readily deliquesce and are so volatile as to sublime at a temperature not much above that of boiling water. When these chlorides are dissolved in water the protochloride forms a green solution, which under exposure to the air deposites sesquioxide of iron and passes to the state of sesquichloride; while the sesquichloride forms a solution of a dark brownish-red tint. Both solutions may be made to yield crystals, though with difficulty; and these crystals are considered by some chemists as chlorides with water of crystallization, by others as hydrochlorates of the protoxide and sesquioxide of iron. The officinal tincture at one time contained both compounds; for the oxide used in making the solution in muriatic acid was the black oxide, which, as will be seen under the head of that article (see *Ferri oxidum nigrum*), is a compound of protoxide and sesquioxide of iron. But as the tincture when so prepared becomes weaker by keeping, in consequence of its protoxide passing gradually to the state of sesquioxide and being in part precipitated, the Colleges have now all substituted the red or sesquioxide for the black oxide; so that a permanent tincture is obtained, consisting entirely of sesquichloride or hydrochlorate of the sesquioxide, with merely a little excess of muriatic acid. The propriety of this change is doubtful, because the salts of protoxide of iron are more active as

tonics than those of the sesquioxide. The Dublin College differs from the sister Colleges in using rust of iron instead of the sesquioxide; but although this preparation is more easily soluble if carefully prepared, it really possesses no substantial advantage. The Dublin College farther directs that the solution of the oxide in the acid shall be concentrated to a third of its volume before the addition of the spirit; the effect of which is to expel the greater part of the large excess of acid used in the Dublin formula. A moderate excess however must always be left, otherwise the tincture soon deposites a part of the sesquioxide, Mr Phillips has found that a fluidounce of the London tincture contains about thirty grains of sesquioxide.

The tincture of the muriate of iron has a reddish-brown colour, a peculiar etherial odour, and a strong acid, astringent, chalybeate taste. Ammonia separates yellow flakes of the sesquioxide. Tincture of galls occasions a black precipitate, and solution of ferrocyanate of potash a blue one. As met with in the shops it is frequently too weak.

Actions and Uses.—This is a favourite chalybeate preparation with many for obtaining the tonic action of iron, and it is an exceedingly convenient form for administration. It has also been thought by some to possess specific virtues in diseases of the urinary organs, and is used somewhat indiscriminately in this class of affections. It is serviceable in dysuria connected with loss of tone in the bladder, and has been found to diminish the mucous secretion in catarrh of that organ. The best mode of prescribing it is simply in a little water. Sometimes it acts as a gentle diuretic; but it is never used expressly for the purpose of acting as such. It is an irritant poison in large doses.

It is usually given in the dose of ten, twenty, or thirty drops twice or thrice a-day.

FERRI OXIDUM NIGRUM, *E. D.* *Ferroso-ferric oxide (Berzelius); a compound of protoxide and sesquioxide of iron.*

TESTS, *Edin.* Dark-grayish-black: strongly attracted by the magnet: heat expels water from it: muriatic acid dissolves it entirely: and ammonia precipitates a black powder from this solution.

PROCESS, *Edin.* Take of
Sulphate of iron, six ounces;
Sulphuric acid (commercial), two fluidrachms and two fluidscruples;
Pure nitric acid, 1½ fluidrachms;
Stronger aqua ammoniæ, four fluidounces and a half;
Boiling water, three pints;

Dissolve half the sulphate in half the water and add the sulphuric acid; boil; add the nitric acid by degrees, boiling the liquid after each addition briskly for a few minutes. Dissolve the rest of the sulphate in the rest of the water; mix thoroughly the two solutions; and immediately add the ammonia in a full stream, stirring the mixture at the same time briskly. Collect the black powder on a calico filter; wash it with water till the water is scarcely precipitated by solution of nitrate of baryta; and dry it at a temperature not exceeding 180°.

PROCESS, *Dub.* Wash and dry the scales of oxide of iron obtained at a blacksmith's forge; separate them from impurities by the magnet; triturate them, and separate the fine powder by the process directed for making prepared chalk.

FOR NAMES — *Fren.* Oxide de fer noir — *Ital.* Ossido nero di ferro.— *Ger.* Schwarzes eisenoxydul; Eisenmohr.— *Russ.* Gelezisto gelesnaia okis.

Chemical History.—AMONG the interminable variety of forms in which iron has been used in medicine, few have been longer or more esteemed than the old *Æthiops martis*, obtained by levigating the scales which are struck from red-hot iron by the blacksmith's hammer. This was at one time thought to be the protoxide of iron, and afterwards to form an oxide intermediate between that and the sesquioxide; but it is now believed to be an irregular compound of both oxides. The protoxide and sesquioxide of iron have the property of uniting together and forming definite compounds. One of these is familiar to mineralogists under the name of magnetic iron ore. The blacksmith's scales, the *Oxidum ferri nigrum*, of the Dublin Pharmacopœia, appear from the researches of Berzelius and of Mosander to consist of one or more analogous compounds, in which the oxides are united in proportions somewhat different from those existing in magnetic iron-ore; and the chemical constitution of the scales is variable. Instead of this variable preparation, the Parisian codex contains another compound of the same nature, which is prepared in the moist way by the slow action of air and water on iron-filings according to a process devised by Guibourt. This appears from the statements of Berzelius to consist essentially of the compound of the two oxides contained in magnetic iron-ore, together with a little hydrated sesquioxide. A farther improvement upon the preparation of Guibourt has been proposed by Wöhler, and adopted by the Edinburgh Pharmacopœia as a substitute for the *Æthiops martis*. The object of the process is to obtain a compound, one-half of the iron of which is in the state of protoxide, and the other in that of sesquioxide. This is accomplished by preparing in the first instance, by means of the precautions mentioned in the College process, a mixture of the sulphates of the protoxide and sesquioxide in the required proportion,—and then precipitating the two oxides suddenly by the prompt addition of an excess of ammonia. The oxides in consequence unite at once in the act of separation, and fall down in the form of a dark grayish-black powder, which, under exposure to the air, whether with or without moisture, shows no tendency to undergo farther oxidation,—a sufficient proof that the oxides are not mixed merely, but chemically combined.

This substance is attracted by the magnet. It has when dry a dark grayish-black colour, and presents a shining fracture when dried in a mass and then broken. When heated in close vessels it gives off water, and sustains no further change; but if heated in an open vessel it soon passes entirely to the state of a brownish-red sesquioxide. It is dissolved by muriatic acid, and may be thrown down again by ammonia unchanged. According to the analysis of Wöhler it is composed of two equivalents of protoxide of iron, one

of sesquioxide, and two of water ($2\ FeO + Fe^2O^3 + 2\ HO$), and consequently of 72 parts of the former oxide, 80 of the latter, and 18 water.——The chemical properties which have just been detailed, more especially the effects of heat, will be sufficient to ascertain whether this compound has been correctly prepared. The black oxide of the Dublin Pharmacopœia may be distinguished from it by not giving off any water when heated.

Actions and Uses.—The new *Æthiops martis* possesses the tonic virtues of chalybeates generally. The Colleges, whether intentionally or not, seem to have long aimed at obtaining chalybeate preparations in which the metal exists in the state of protoxide. This circumstance seems to have arisen from the prevailing, and probably well founded belief among practical men, that the compounds of the protoxide are the most efficacious. Hence it appears that the efforts of the Colleges should still be turned towards the improvement of that class of chalybeates. The old *Æthiops martis* is one of these, which for a long time and till lately enjoyed great reputation; and the decline of its reputation in recent times has probably been owing in part to its irregular composition, and partly to the caprice of fashion.—A substitute is therefore desirable; and the black oxide of the Edinburgh College possesses at least all the properties of the original preparation, as well as the advantage of being a definite compound scientifically prepared.

The dose is from five to twenty grains.

FERRI OXIDUM RUBRUM, *E.* FERRI SESQUIOXIDUM, *L.* FERRI CARBONAS, *D.* *Sesquioxide of iron. Peroxide of iron (by precipitation).*

TESTS, *Edin.* Entirely soluble in muriatic acid, aided by gentle heat.
TESTS, *Lond.* Entirely soluble in hydrochloric acid with slight effervescence; and again precipitated by ammonia.

PROCESS, *Edin.* Take of
Sulphate of iron, four ounces;
Carbonate of soda, five ounces;
Boiling water, half a pint;
Cold water, three pints and a half.
Dissolve the sulphate in the boiling water, add the cold water, and then the carbonate of soda previously dissolved in about thrice its weight of water. Collect the precipitate on a calico filter; wash it with water till the water is but little affected by solution of nitrate of baryta; and dry it in the hot-air press or over the vapour-bath.

PROCESS, *Lond.* Take of
Sulphate of iron, four pounds;
Carbonate of soda, four pounds and two ounces;
Boiling water, six gallons.
Dissolve the salts separately, each in three gallons of the water; mix the solutions, and let the precipitate subside; wash the precipitate well with water, and dry it.

PROCESS, *Dub.* Take of
Sulphate of iron, twenty-five parts;
Subcarbonate of soda, twenty-six parts;
Water eighty parts.
Dissolve the sulphate in the water, and add the carbonate previously dissolved in sufficient water; mix them well; wash the precipitated carbonate of iron with warm water, and dry it.

FERRI OXIDUM RUBRUM, *D.* *Sesquioxide of iron, (by decomposing the sulphate by heat).*

PROCESS, *Dub.* Heat the sulphate of iron to drive off its water of crystallization, and then with a strong heat so long as acid vapours escape. Wash the product till the water does not redden litmus, and dry it on bibulous paper.

EMPLASTRUM FERRI, E. EMPLASTRUM THURIS, D.

PROCESS, *Edin.* Take of
Litharge plaster, three ounces;
Resin, six drachms;
Olive-oil, three fluidrachms and a half.
Bees'-wax, three drachms;
Red oxide of iron, one ounce.
Triturate the oxide of iron with the oil, and add the mixture to the other articles previously melted with a gentle heat. Mix the whole thoroughly.

PROCESS, *Dub.* Take of
Litharge plaster, two pounds;
Frankincense, and
Red oxide of iron, of each three ounces;
Melt the plaster and frankincense together, sprinkle in the oxide, stirring at the same time, and make a plaster.

FOR. NAMES.—*Fren.* Peroxyde de fer.—*Ital.* Ossido rosso di ferro.—*Ger.* Eisenoxyd.—*Russ.* Okis geleza.

Chemical History.—THE whole Pharmacopœias of the British empire at one time contained, like the last Dublin edition, two formulas for preparing, the one the sesquioxide of iron, and the other a compound, which was supposed to be a carbonate of that metal, but which is in fact generally nothing else than the sesquioxide in a different form. When sulphate of iron is subjected to a gradually increasing heat, it first parts with water of crystallization, and then with its acid, till at length nothing is left but the sesquioxide, which is formed from the protoxide at the expense of a part of the sulphuric acid of the salt. The product, freed of any adhering undecomposed sulphate by washing it with water, is the old Colcothar of vitriol, a pure sesquioxide of iron, of a dark chocolate colour. When sulphate of iron, on the other hand, is decomposed in solution by something more than its own weight of carbonate of soda, and the carbonate thus formed is dried in the air, the protoxide of the carbonate attracts oxygen from the atmosphere, while the carbonic acid passes off; and at length there remains a rust-coloured powder, which is sesquioxide of iron, commonly with a trace of carbonic acid. This preparation, which was long erroneously considered a carbonate of iron, still retains that name in the Dublin Pharmacopœia. As the two preparations here described are essentially the same, it seems unnecessary to retain both; and as the colcothar is both more troublesome to prepare, and less easily soluble in acids than the oxide obtained by precipitation, the latter has alone been retained by the Edinburgh and London Colleges. The London College has assigned to it its most modern scientific name; while the Edinburgh College, in order to avoid the fluctuations of scientific nomenclature, has transferred to it the pharmaceutic name of the rejected colcothar.

This red oxide, or sesquioxide, of iron is a yellowish-red powder, of a chalybeate taste, and entirely soluble in muriatic acid. The article met with in the shops varies somewhat in constitution; which probably depends on the following circumstances. If boiling water be used in the mutual decomposition of the salts, as the London

College directs, and the precipitate be heated a little above 212° in drying it, the product contains some black, or ferroso-ferric, oxide; for it is feebly attracted by the magnet. But there is neither carbonic acid nor water present. If the heat in drying it do not exceed 140°, the product, besides being somewhat magnetic, contains combined water and a small, though sensible, proportion of carbonic acid. If again the salts be mixed in a state of cold solution, as in the Edinburgh formula, the precipitate, in whatever way it may be dried, contains no black oxide and only a trace of carbonic acid, while the presence of combined water depends, as in the former case, on the temperature used in drying it. The proper process then for a pure sesquioxide is, I apprehend, that of the Edinburgh College.

Adulterations.—The sesquioxide may be adulterated with brick-dust. This is left behind when the oxide is dissolved by muriatic acid, aided by a gentle heat.

Actions and Uses.—The sesquioxide of iron, under the name of carbonate, has been long a favourite preparation with many for the general purposes for which chalybeates are used as tonics. In recent times it has come into notoriety as a remedy for neuralgia of all kinds, more especially for tic-douloureux and other allied affections. It was first recommended in these disorders by Mr Hutchinson; and the experience of the profession has confirmed his representations. It is most useful in the forms of neuralgia connected with derangement of the functions of the stomach. It is given in doses of one, two, or three drachms several times a-day; and it is usually administered in the form of electuary made with orange-confection and syrup, because doses so bulky cannot be conveniently taken in any other mode. Some have given it in far larger quantity; and patients have even been made to swallow the enormous amount of two or three pounds in the course of a week. There can be no question however that such doses are either wholly unnecessary, or furnish strong presumption, that the particular preparation is unscientific and not well fitted for its purpose. The latter proposition seems exceedingly probable; for the sesquioxide, as obtained by the process of the Colleges, is with difficulty dissolved by weak or diluted acids, so that only a small proportion of what is usually taken for a dose can come into operation. Many practitioners have complained of the irregularity of its action; and it is clearly in general an inert preparation compared with other chalybeates. Some have supposed that the only really active part of it is the small proportion of carbonate or protoxide which it may contain; and this supposition derives some support from the circumstance, that, if its physiological action is always slight and its therapeutic effects irregular, the proportion of carbonate in it is likewise not less variable, and sometimes quite insignificant. Upon the whole it must be admitted to be a clumsy preparation for internal use; and a substitute is desirable. In all probability this

substitute will be found either in the hydrated sesquioxide or in a permanent carbonate of the protoxide (see *Ferrugo* and *Ferri carbonas saccharatum*); both of which have been introduced into the new Edinburgh Pharmacopœia.——The precipitated sesquioxide may be used instead of the colcothar for making plasters. In pharmaceutic chemistry it is employed for preparing the tincture of the muriate of iron, and the Dublin acetate of iron.

Its forms and doses are: *Oxidum ferri rubrum*, E. *Ferri sesquioxidum*, L. *Ferri carbonas*, D. dr. ss. ad dr. iv.—*Emplastrum oxidi ferri rubri*, E. D. externally.

FERRI PERCYANIDUM, *L.* See *Ferri Cyanuretum*.

FERRI POTASSIO-TARTRAS, *L.* See *Ferrum Tartarizatum*.

FERRI SULPHURETUM, *E. D.* *Protosulphuret of iron. Sulphuret of Iron.*

TESTS, *Edin.* Soluble in a great measure in diluted sulphuric acid, with effervescence and disengagement of sulphuretted-hydrogen gas.

PROCESS, *Edin.* Take of
Iron-filings, three parts;
Sublimed sulphur, one part.
Mix them thoroughly; heat the mixture in a covered crucible till it become red-hot; remove the crucible from the fire and allow the action to go on without heat.

PROCESS, *Edin. Dub.* A purer sulphuret may be obtained by heating an iron-rod to a white heat in a blacksmith's forge, applying a stick of sulphur to the end of the rod, and collecting in water the fused globules which fall down. These should be freed of sulphur and kept in a close vessel.

FOR. NAMES.—*Fren.* Sulphure de fer.—*Ital.* Solfuro di ferro.—*Ger.* Schwefeleisen.—*Russ.* Sernistoe gelezo.

THERE are several sulphurets of iron, but only one in the Pharmacopœias, namely the protosulphuret; which is not used medicinally, but is of great importance in pharmacy as the readiest material for yielding sulphuretted-hydrogen gas. The sulphuret however which is obtained by the College processes is not a pure protosulphuret. It contains an excess of iron, especially that which is prepared from iron-filings by one of the Edinburgh processes. — Sulphuret of iron is most easily made by heating a mixture of sulphur and iron-filings to a low red heat in a crucible. They speedily begin to combine; and the action is accompanied with sufficient heat to bring the whole mass quickly to a bright red glow, though the crucible be withdrawn from the fire. The sulphuret obtained in this way always contains a large excess of iron. It is obtained of greater purity according to the second of the processes of the Edinburgh College, by applying a rod of sulphur to a rod of iron heated to a white heat in a blacksmith's forge. For the success of this process it is essential that the iron be raised to a full white heat. At a lower temperature the sulphur

is merely fused on its surface; but if the heat be high enough, the two bodies unite with the emission of brilliant sparks, and the sulphuret falls down in a fused and incandescent state. On being received into water as it falls, brownish-yellow globules are obtained, which have a somewhat crystalline texture. Both forms of the protosulphuret of iron are easily known by dissolving in diluted sulphuric acid, with brisk effervescence from the escape of sulphuretted-hydrogen gas, and with the formation of the protosulphate of iron. This is the surest method of obtaining a pure sulphate of the protoxide, because the evolution of sulphuretted-hydrogen prevents the formation of any sesquioxide. Along with that gas a considerable proportion of hydrogen is also disengaged, on account of the presence of free iron in the sulphuret; and the largest proportion of hydrogen is produced from the variety of the sulphuret prepared with iron-filings. The pure protosulphuret of iron is composed of one equivalent of each element (FeS), and consequently of 28 parts of metal and 16.1 sulphur.

Sulphuretted-hydrogen as produced by sulphuret of iron is a very important pharmaceutic agent.

FERRUGO, *E.* FERRI RUBIGO, *D.* *Hydrated sesquioxide of iron. Rust of iron.*

Tests, *Edin.* Entirely and easily soluble in muriatic acid, without effervescence: if previously dried at 180°, a stronger heat drives off about 18 per cent of water: the magnet does not attract it.

Process, *Edin.* Take of
Sulphate of iron, four ounces;
Sulphuric acid (commercial) three fluid-drachms and a half;
Nitric acid, D. 1380, nine fluidrachms;
Stronger aqua ammoniæ three fluidounces and a half;
Water two pints.
Dissolve the sulphate in the water, add the sulphuric acid, and boil the solution; add then the nitric acid in small portions, boiling the liquid for a minute or two after each addition until it acquires a yellowish-brown colour and yields a precipitate of the same colour to ammonia: Filter; let the liquid cool; and add in a full stream the aqua ammonia, stirring the mixture briskly. Collect the precipitate on a calico filter; wash it with water till the washings cease to precipitate with nitrate of baryta; squeeze out the water as much as possible; and dry the precipitate at a temperature not above 180°.

When this preparation is kept as an antidote for poisoning with arsenic, it is preferable to preserve it in the moist state, after being simply squeezed.

Process, *Dub.* Take any quantity of iron wire in fragments; moisten it frequently with water and expose it to the air till it be converted into rust. Triturate the product in an iron mortar, separate the finer powder by pouring water over it; collect the powder, and dry it.

For. Names.—*Fren.* Hydrate de peroxyde de fer.—*Ger.* Eisenoxydhydrat.—*Russ.* Vodraia okis gelezo.—*Arab.* Sudeed al hedeed —*Pers.* Zafrani ahun.—*Tam.* Eerumboo tupoo.

Chemical History.—When iron is subjected to the action of atmospheric air and a free supply of water, it is gradually converted into the sesquioxide, and at the same time unites with a portion of water. The yellow hydrate thus obtained is the old rust of iron, a chalybeate long held in much estimation. The process is tedious.

Its result too is uncertain. If the iron be not kept constantly covered with water, the product has a dark brown colour, is strongly attracted by the magnet, and contains some black, or ferroso-ferric, oxide. But if the water be renewed so as to keep the iron always submerged, the result is a pale yellowish-brown powder, which is not at all affected by the magnet, and contains no oxide but the sesquioxide. The Dublin College, which alone retains this process, erroneously directs that the iron be merely kept moist.

Not essentially different from this preparation is the hydrated sesquioxide, or, as it is commonly called, peroxide of iron, which has been lately recommended as an antidote for poisoning with arsenious acid, and which is obtained by decomposing with ammonia any ferruginous salt that contains the metal in the state of sesquioxide. This variety of the hydrated sesquioxide may be prepared by dissolving iron-wire in nitric or nitromuriatic acid and decomposing the solution with ammonia; but a readier method is that which has been adopted by the Edinburgh College. Common green vitriol, the sulphate of the protoxide, is converted into the sulphate of the sesquioxide by means of nitric acid aided by heat. The nitric acid is decomposed, nitric oxide gas passes off, and part of the oxygen of the acid unites with the protoxide of iron. As there is too little sulphuric acid in the protosulphate to maintain the iron in solution when it passes to the state of sesquioxide, an insoluble basic salt would be thrown down; but this is prevented by adding the necessary proportion of sulphuric acid to form the sulphate of the sesquioxide, namely half the amount of acid contained in the green vitriol employed. In subsequently decomposing the sulphate by ammonia, care must be taken to add the ammonia in excess and at once; otherwise a basic sulphate is apt to be thrown down instead of the sesquioxide.—The quickest way to make this preparation is to dissolve the common red oxide in strong muriatic acid, and to precipitate the hydrated sesquioxide by ammonia.

The hydrated sesquioxide prepared in any of these ways is a yellowish-brown powder, much more easily soluble in acids, especially in diluted acids, than the same oxide in its anhydrous state. If it has been properly prepared, without being exposed to too much heat in the process of drying, it gives off water freely on being heated in a tube, and then presents the characters of the anhydrous sesquioxide, commonly called colcothar of vitriol. It also gives off however a little ammonia; and the same circumstance has been observed of the hydrate obtained, according to the Dublin process, by the rusting of iron. According to Berzelius rust of iron contains 14.7 per cent of water, which would make its constitution approach closely to two equivalents of sesquioxide and three of water. The hydrate obtained by precipitating the muriate of the sesquioxide by ammonia consists, according to Turner, of one equivalent of sesquioxide and two of water ($Fe^2\,O^3 + 2\,HO$), that is 80 parts of the former

and 18 of the latter; and such appears from my own experiments to be also the composition of what is obtained by the process of the Edinburgh College from the sulphate. This hydrate possesses the important property of immediately removing arsenious acid from solution in water when agitated with it; and an insoluble arsenite of iron seems to be formed. The anhydrous sesquioxide has no such property.

Actions and Uses.—The Rust of iron, as prepared by the Edinburgh formula, was proposed by Messrs Bunsen and Berthold as an antidote for poisoning with arsenic; and repeated experiments, physiological as well as chemical, have confirmed their statements. The results of numerous trials, both with animals and in cases of poisoning in the human subject, are such as to render it indispensable on the part of every druggist to have the hydrated sesquioxide of iron in readiness. There can be no question, notwithstanding some statements to the contrary, that, when well prepared either in the form of magma, or dried at a moderate heat and afterwards pulverized with water, it immediately removes arsenious acid so thoroughly from an aqueous solution that even sulphuretted-hydrogen will not indicate the presence of the poison. According to some an insoluble arsenite of iron is formed; but others maintain, that the ammonia is an essential ingredient in the antidote, and enters into the constitution of the insoluble compound which is produced. The antidote should be given freely,—to the extent of at least twelve times the arsenic swallowed. For this particular purpose there is no occasion to dry it: it may be very conveniently kept in the form of magma, in which state it acts more quickly upon arsenic in solution. It is a mistake however to say that the dry rust has no effect. It acts in the same way, but more slowly, when it has been dried, provided it retains its combined water. When kept very long in water, it becomes crystalline, loses half its water of crystallization, and is much less easily soluble in weak acids [Wittstein].

The hydrated sesquioxide of iron may be advantageously employed for other more familiar objects. It cannot but prove an excellent chalybeate; and from its superior solubility it must be preferable to the anhydrous sesquioxide now commonly used under the incorrect name of carbonate of iron.

Its dose as a tonic is from five to twenty grains.

FERRI SULPHAS, *E. L. D.* *Sulphate of Protoxide of iron.*

Tests, *Edin.* Pale bluish-green crystals, with little or no efflorescence.

Tests, *Lond.* Bluish-green; soluble in water; this solution does not deposit copper upon iron immersed in it.

Process, *Edin.* If the sulphate of iron of commerce be not in transparent green crystals, without efflorescence, dissolve it in its own weight of boiling water acidulated with a little sulphuric acid; filter; and set the solution aside to crystallize. preserve the crystals in well-closed bottles.

Process, *Lond.* Take of
Iron-filings, eight ounces;
Sulphuric acid, fourteen ounces;
Water, four pints.

Mix the acid and water, add the iron, apply heat, and when the effervescence is over, filter. Set the liquid aside to crystallize, and then concentrate the supernatant liquor to obtain more crystals. Dry these.

PROCESS, *Dub.* Take of
Iron-wire, four parts
Sulphuric acid, seven parts ;
Water, sixty parts.
Dissolve the metal with the aid of heat, filter through paper, set the liquor aside to crystallize after due concentration.

FERRI SULPHAS EXSICCATUS, *E.* *Anhydrous sulphate of protoxide of iron.*

PROCESS, *Edin.* Expose sulphate of iron to a moderate heat in an unglazed earthen vessel till it become white and perfectly dry.

PILULAE FERRI SULPHATIS, E.

PROCESS, *Edin.* Take of
Dried sulphate of iron, two parts ;
Extract of taraxacum, five parts ;
Liquorice-root powder, three parts ;
Conserve of red roses, five parts.
Beat them together into a proper mass, which is to be divided into five-grain pills.

PILULAE ALOES ET FERRI, E.

PROCESS, *Edin.* Take of
Sulphate of iron, three parts ;
Barbadoes aloes, two parts ;
Aromatic powder, six parts ;
Conserve of red roses, eight parts.
Pulverize the aloes and sulphate of iron separately ; mix the whole ingredients, and beat them into a proper mass ; which is to be divided into five-grain pills.

PILULAE RHEI ET FERRI, E.

PROCESS, *Edin.* Take of
Dried sulphate of iron, four parts ;
Extract of rhubarb, ten parts ;
Conserve of red roses, five parts.
Beat them into a proper pill-mass, and divide it into five-grain pills.

FOR. NAMES.—*Fren.* Sulphate de fer ; Couperose verte —*Ital.* Solfato di protossido di ferro ; Vetriolo verde ; Copparossa verde.—*Span.* Vitriolo verde ; Copparosa.—*Port.* Capparosa verde ; Vitriolo de ferro.—*Ger.* Schwefelsaures eisenoxydul ; Grüner vitriol.—*Swed.* Grön witriol.—*Dan.* Grön vitriol ; Jern vitrol.—*Russ.* Sernokislaia zakis geleza ; Zelenoi kupores.—*Pers.* Zunkar madenee.—*Tam.* Anna baydie.

SULPHATE OF IRON (Green vitriol,—Copperas) has been known from remote antiquity.

Chemical History.—It is obtained as a natural product from aluminous chalybeate springs, as well as by the spontaneous decomposition of certain native sulphurets of iron, or iron-pyrites ; and it is prepared in large quantity for a variety of purposes in the arts by first roasting these ores and then exposing them to the action of air and water. The sulphur and iron are thus both oxidated, and sulphate of iron is obtained by crystallizing the lixiviated mass. In this state it commonly contains copper and alumina in the form of sulphates ; but the former is removed by mixing the solution with iron, which simply takes the place of the copper ; and the latter, by reason of its great solubility, remains in the mother liquor from which the sulphate of iron is crystallized. Another occasional impurity, the sulphate of zinc, cannot be removed by any easy process.

On account of the risk of these impurities and the cheapness of its component ingredients, sulphate of iron is also made on the great scale in this country for employment in the arts by such processes

as those given by the London and Dublin Colleges. As it is obtained in general of good quality from the manufacturing chemist, the Edinburgh College has been satisfied with directing the commercial salt to be used, or to be purified, if necessary, by recrystallization. When iron is immersed in diluted sulphuric acid it is promptly dissolved, with brisk effervescence,—the metal being oxidated at the expense of the water, and the liberated hydrogen passing off in the gaseous form. If the acid is not considerably diluted, the action ceases, before neutralization, as soon as the sulphate formed is sufficient to require all the remaining water to dissolve it; but the action is renewed on either diluting the liquid with more water or heating it so as to increase the solvent power of the water over the salt.—The Dublin process is preferable to that of the London College, because iron-wire is purer from the first than iron-filings, and it is also difficult to obtain the latter free of dust and other mechanical admixtures. In order to obtain crystals free of sesquioxide of iron it is necessary that the solution shall always contain a slight excess of sulphuric acid. A very pure salt may be obtained by adding 200 parts of iron-filings in successive portions to 330 of acid diluted with 1000 of water,—boiling down the solution immediately in an iron vessel to the density 1340,—filtering through a filter acidulated with sulphuric acid into a porcelain basin similarly acidulated—and allowing crystals to form (Boudet). These crystals are colourless, and may be long kept so in close vessels.

Sulphate of iron is of a bluish-green colour, and possesses a strong, acid, inky, astringent taste. It crystallizes readily; and its crystals have the rhombic prism for their primitive form. Under exposure to the air it both effloresces slightly and also attracts oxygen; so that some sesquioxide forms on its surface, united with sulphuric acid in the state of a basic salt. There is a great difference between different samples as to the rapidity of this change. I have had crystals of a very pure salt which underwent no change whatever after free exposure in a room for several months. The presence of a slight excess of acid is the cause of this (Bonsdorff). Sulphate of iron when heated, first fuses in its water of crystallization; which then passes gradually off till at length a white anhydrous salt remains. This is the *Sulphas ferri exsiccatus* of the Edinburgh Pharmacopœia, which is supposed to be more convenient than the crystallized salt for making pills. A higher heat expels the acid in the form of sulphuric and sulphurous acids, and the oxide remains of a chocolate colour, peroxidated at the expense of a portion of the sulphuric acid. The oxide thus obtained is the old Colcothar of vitriol. Water freely dissolves the sulphate, in the proportion of seven-tenths of its weight at 60°, and to the amount of three times its weight at 212° (Brandes). This solution readily attracts oxygen from the air, and sesquioxide is formed. But the addition of a few drops of sulphuric acid prevents or greatly retards the change.

Sulphate of iron is insoluble in alcohol. It is decomposed in solution by alkalis and their carbonates, by the salts of lime and baryta, and by all vegetable matters which contain tannin. In the last case a dark bluish-black or greenish-black precipitate forms, the tannate of iron, and basis of ink. Ferrocyanate of potash throws down a pale-blue precipitate, which soon acquires a deep blue tint under exposure to the air, and becomes Prussian-blue. The salt is composed of one equivalent of protoxide of iron, one equivalent of sulphuric acid, and seven equivalents of water ($SO^3 + FeO + 7 Aq$), and consequently of 36 parts of base, 40.1 of acid, and 63 of water. Hence the crystallized salt contains little more than one-half of real sulphate; a difference between it and the anhydrous salt, which must be attended to in prescribing them. As six of the equivalents of water are easily expelled by heat, while a much higher heat is necessary to drive off the seventh, this equivalent is considered by Professor Graham to exist in the salt as a base, so that the constitution of sulphate of iron according to his view is $FeO\ SO^3\ HO + 6\ Aq$.

Adulterations.—The adulterations of sulphate of iron as now sold in this country are insignificant. It should be of a pale pure bluish-green colour, not yellow or with a yellowish efflorescence; otherwise it contains sesquioxide. It ought not to deposite a brown crust on a polished plate of iron immersed in its solution, or yield a blue solution when peroxidated by ebullition with nitric acid, precipitated with an excess of ammonia, and then filtered; otherwise it contains copper (see *Cupri sulphas*). Zinc is discovered by adding an excess of ammonia to the solution similarly peroxidated, filtering the fluid, and expelling the excess of ammonia from it by ebullition; upon which white oxide of zinc separates in flakes.

Actions and Uses.—Sulphate of iron is an irritant, astringent, and tonic. Though the experiments of Smith show that doses of two drachms may prove fatal to dogs, it appears to be a feeble irritant, and is not generally ranked among poisons. Doses however which somewhat exceed the ordinary medicinal doses excite nausea, pain in the stomach and vomiting; and I have met with a case where about half an ounce seemed to have proved fatal to a child. In small doses, it possesses the tonic virtues of chalybeate remedies in an eminent degree, and is probably one of the best, as it is the most uniform, of the preparations of iron. It is much given as a tonic in dyspepsia, in amenorrhœa, and in convalescence from exhausting diseases. The Edinburgh *Pilula ferri sulphatis* is a good form for such purposes. Although undoubtedly a topical astringent, it has been thought by some to possess laxative qualities. This is doubtful. But it certainly has the effect of increasing the activity, while it lessens the irritating action, of some resinous purgatives, especially aloes. The Edinburgh *Pilula aloes et ferri* is a preparation of this kind, which answers excellently as a mild laxative in dyspepsia or for general purposes; and the *Pilula rhei et*

ferri is also of the same nature.——The solution of the sulphate, especially in the form of mineral water, has been found a useful astringent lotion for indolent or ill-conditioned ulcers.

Its forms and their doses are: *Sulphas ferri*, E. L. D. gr. i. ad gr. v.—*Sulphas ferri exsiccatus*, E. gr. ss. ad gr. iii.—*Pilulæ sulphatis ferri*, E. gr. x. ad gr. xx.—*Pilulæ aloes et ferri*, gr. x. ad gr. xv.—*Pilulæ rhei et ferri*, gr. x. ad gr. xv.

FERRUM TARTARIZATUM, *E.* FERRI POTASSIO-TARTRAS, *L.* FERRI TARTARUM, *D.* *Tartrate of Potash and Iron.*

TESTS, *Edin.* Entirely soluble in cold water: taste feebly chalybeate: the solution is not altered by Aqua potassæ, and is not precipitated by solution of ferrocyanide of potassium.

TESTS, *Lond.* Entirely soluble: without action on litmus or turmeric: not visibly affected by ferrocyanide of potassium, acids, or alkalis: not attracted by the magnet.

PROCESS, *Edin.* Take of
Sulphate of iron, five ounces;
Bitartrate of potash, five ounces and one drachm;
Carbonate of ammonia in fine powder, a sufficiency.
Prepare rust of iron from the sulphate as directed for *Ferrugo*, and without drying it. Mix the pulpy mass with four pints of water; add the bitartrate; boil till the rust of iron is dissolved; let the solution cool; pour off the clear liquid, and add to this the carbonate of ammonia so long as it occasions effervescence. Concentrate the liquid over the vapour-bath to the consistence of thin extract, or till the residuum becomes on cooling a firm solid; which must be preserved in well closed vessels.

PROCESS, *Lond.* Take of
Sesquioxide of iron, three ounces;
Hydrochloric acid, half a pint;
Solution of potash, four pints and a half or a sufficiency;
Bitartrate of potash, eleven ounces and a half;
Solution of sesquicarbonate of ammonia, a pint or a sufficiency;
Distilled water, three gallons.
Digest the sesquioxide in the acid for two hours in a sand-bath, add two gallons of water, let the solution rest for an hour, and pour off the clear liquid. Precipitate the liquid with the solution of caustic potash, wash the precipitate well with water, and while it is moist boil it with the bitartrate in a gallon of distilled water. And so on, as in the Edinburgh process.

PROCESS, *Dub.* Take of
Iron-wire, one part;
Bitartrate of potash in very fine powder, four parts;
Distilled water, eight parts or a sufficiency.
Mix them, and expose them for fifteen days to the air in a wide vessel, stirring occasionally, and replacing the water so as to keep the mass moist without covering it. Boil the product in a sufficiency of distilled water, evaporate the solution to dryness in the vapour-bath, and keep the tartrate of iron in a well-closed phial.

FOR. NAMES.—*Fren.* Tartrate de potasse et de fer.—*Ital.* Tartrato di potasso et di ferro; Marte solubile.—*Ger.* Eisenweinstein.—*Russ.* Vinnokisloe kali sokisiu geleza.

Chemical History.—THIS preparation, formerly called *Globuli martiales*, and when dissolved in wine, *Vinum martiale*, was once directed in all the Pharmacopœias to be made by the process still followed by the Dublin College. According to that method, when iron-filings and bitartrate of potash are kept constantly moist and exposed to the air, the iron is converted into the sesquioxide partly by the oxygen of the air, partly by the decomposition of water; and the sesquioxide at the same time unites with one-half of the acid of

the bitartrate, forming a double tartrate. This is freed from impurities by dissolving it in boiling water and evaporating off the water from the solution. A much superior process however is that of Soubeiran, now adopted by the Colleges of London and Edinburgh. The hydrated sesquioxide is first obtained, either according to the Edinburgh formula from the sulphate (see *Ferrugo*), or more laboriously by the London method from the muriate of the sesquioxide, which is first made by dissolving the sesquioxide in muriatic acid, and then decomposed by solution of caustic potash. The hydrated sesquioxide, got in either of these ways, is boiled with bitartrate of potash and water; upon which it is promptly dissolved, more especially if it be not dried, but used in the form of pulp after being merely washed; and thus a solution of the double tartrate is formed. Any little excess of acid is next neutralized by carbonate of ammonia, and the tartrate of potash and iron is finally obtained by gently evaporating the solution to dryness.

The tartrate of potash and iron is a greenish-brown powder, uncrystallizable, of a faintly chalybeate, sweetish, somewhat alkaline taste, deliquescent, and soluble in four parts of water (Geiger), forming a greenish-brown solution. It is slightly soluble in rectified spirit, more soluble in proof-spirit, or vinous fluids. All its solutions differ remarkably from the other solutions of chalybeate salts in possessing but a faint chalybeate taste, and in not being decomposed by the addition of either alkalis or alkaline carbonates unless with the aid of heat. Acids do not visibly affect it. Ferrocyanate of potash does not precipitate it; but it yields the usual dark precipitate with vegetable astringents. According to Mr Phillips it contains about 18 per cent of sesquioxide of iron. If this be the case, it must be considered a compound of two equivalents of tartrate of potash and one of tartrate of iron, that is four of tartaric acid, two of potash, and one of sesquioxide of iron ($4\overline{T}+2KO+Fe^2O^3$), —and consequently 265.9 acid, 94.3 potash, and 80 oxide of iron. Wackenroder however maintains that this salt contains both oxides of iron, even when prepared by Soubeiran's method; for if a concentrated solution be heated with solution of potash, the precipitate which falls down is not the sesquioxide of iron, but the black oxide. And Wittstein, confirming this statement, finds the true composition to be four equivalents of tartrate of potash, three of tartrate of sesquioxide of iron, and one of tartrate of the protoxide ($4\overline{T}KO+3\overline{T}Fe^2O^3+\overline{T}FeO$).

Actions and Uses.—This preparation has been long known as a chalybeate, and is highly commended by some. Yet, although it has the advantage of being superior to other active chalybeates in point of taste, it has never come into general use in this country. It is administered in doses of from five to ten grains. The Pharmacopœias formerly contained a wine of iron, which consisted essentially of this salt dissolved in white wine; and a convenient

chalybeate might be made with the new preparation in the same menstruum.

At present the simple salt is the only recognized officinal form: gr. v. to gr. x. are usually given for a dose.

FERULA ASSAFOETIDA, *D.* See *Assafœtida.*

FICI. *Dried fruit of Ficus Carica, L. W. Spr.*

FOR. NAMES.—*Fren.* Figue.—*Ital.* Fico.—*Span* Higo.—*Port.* Figos.—*Ger.* Feige.—*Dut.* Vijg.—*Swed.* Fikon.—*Dan.* Figen.—*Russ.* Smokovnitsa.—*Arab.* Teen.—*Pers.* Unjeer.—*Tam.* Sirnie attic pullum.

Ficus Carica figured in Nees von E. 97.—Hayne, ix. 13.—Steph. and Ch. iii. 154.

THE fig has been known immemorially, both as an article of food and in medicine. It is the Συκον of the Greeks.

Natural History.—The plant which produces it belongs to the Linnæan class and order *Polygamia Diœcia*, and to the Natural family *Urticaceæ*. This is in temperate countries a large bush, which in hotter climates becomes a small, crooked tree. It withstands the cold even of this country, and in most summers ripens its fruit even in Scotland; but it thrives best in the south of Europe, northern Africa, and Asia Minor,—in which last country it is believed to be indigenous. It has a creeping root, which pushes up numerous shoots as it spreads. It produces fruit at most seasons of the year in genial climates. The fruit is pyriform and its structure peculiar. At first it is nothing more than a fleshy receptacle; but, as it advances to maturity, minute flowers form in a cavity, which occupies the centre of the mass and communicates outwardly by a small round aperture at the summit; and these flowers are succeeded by many small roundish seeds. While young the fig abounds, like the trunk and branches, with a milky, aromatic, acrid juice, destitute of sweetness. But as it ripens, sugar and mucilage are formed, and the acridity disappears. The fresh ripe fig has a peculiar sweet mucilaginous taste, which is sweetest and most delicate in those of warm countries. The sweetness increases during the process of partial drying, which is practised before storing them for preservation. Dried figs are prepared in great quantity in all countries where the tree thrives and produces fruit abundantly. They are dried in the sun, eight or ten days being commonly required for the purpose. Figs present very great varieties, arising chiefly from the influence of cultivation. They differ in size, toughness of skin, flavour, and especially in colour, some when fresh being whitish, others yellow, others brown, red, or violet. The druggists and grocers of France distinguish three sorts, called White, Purple, and Fat Figs (Figues blanches—violettes—grasses). Of these the white sorts, prepared in the neighbourhood of Marseilles, are most esteemed for the table; while the others, being tougher in the skin,

larger, and less delicate, are principally used in medicine, or for seasoning articles of food or drink.

Chemical History.—The fig contains chiefly mucilage and sugar, the latter of which approaches nearest grape-sugar in its properties; but it is singular that no careful analysis of this important fruit has been hitherto executed. The milky juice obtained from the branches of a tree growing in Germany contained resin, gum, albumen, extractive matter, a principle resembling caoutchouc, and various salts (Geiger and Reimann). But the source of the acridity of the juice has not been discovered.

The finest fig is the small white variety. The thick-skinned sort is inferior; and those which are brown, or old, or worm-eaten, acid to the sense of smell, or of a bitterish taste, must be rejected.

Actions and Uses.—Figs are nutritive and demulcent in their action. They form a common article of food wherever they abound; and they are generally held to be very nutritious. So high was the opinion entertained of them in this respect by the earlier Greeks, that they long constituted the principle article of food of the Athletes. Some have thought their habitual use engenders intestinal worms; others that they cause diarrhœa, and in moderation tend to correct a costive habit. In medical practice they were considered in ancient times, and are indeed still held by some, to be useful internally as emollients in catarrh, pneumonia, and cynanche tonsillaris, and externally in the form of poultice for promoting healthy suppuration. But in modern physic they are little employed even dietetically, and their use is in a great measure confined to seasoning decoctions or imparting a due consistence to electuaries. Two officinal preparations contain them; namely the *Decoctum hordei compositum*, and the *Confectio* or *Electuarium sennæ*. In the Canary Isles, Portugal, and the Grecian Archipelago a spirituous liquor is prepared from them by fermentation with water and subsequent distillation (Mérat).

FILIX, *E.* ASPIDIUM, *L.* ASPIDII FILICIS MARIS RADIX, *D.* *Rhizoma of Nephrodium Filix-mas, Rich. Bot. Méd.* (*Edin.*) *Root of Aspidium Filix-mas, Smith, Brit. Fl.* (*Lond. Dub.*) *Male Shield Fern.*

FOR. NAMES.—*Fren.* Fougère male.—*Ital.* Felce mascolino.—*Span.* Helecho masculino.—*Port.* Feto macho.—*Ger.* Männliche waldfarren; Bandwurmwaldfarrenkraut.—*Dut.* Varren mannetje.—*Swed.* Träjon.—*Dan.* Bregne.—*Russ.* Paporotnik mugeiskoi.

FIGURES of Aspidium Filix-mas in Nees von E. 27.—Engl. Bot. 1558.

THE root of the MALE SHIELD FERN is a very old remedy, and is thought to have been the Πτερις or Πτεριον of Dioscorides. After long neglect it has again recently become an important article of the Materia Medica.

Natural History.—The plant belongs to the Linnæan class and or-

der *Cryptogamia Filices*, and to the Family *Filicaceæ* in the Natural arrangement. It is the *Nephrodium Filix-mas* of Richard, and Lindley, the *Polypodium Filix-mas* of Linnæus, *Aspidium Filix-mas* of Willdenow, Smith, Swartz, and *Lastræa Filix-mas* of Presl and other authors. It abounds in all parts of Europe, and grows especially on stony places at the edges of woods, in open plantations, and on roadsides. It produces beautiful leaves about three feet long, simply pinnate, with leaflets deeply cut and toothed towards the apex. The officinal part is the root, or rather, as the Edinburgh Pharmacopœia has it, the root-stock. This is perennial, horizontal, creeping, about a foot long, from one to three inches thick, and composed chiefly of oblong tufts or knobs, which are the persistent bases of the old leaf-stalks, and which are fleshy, greenish-black externally, greenish-white within, and everywhere covered with rusty-coloured scales. From the root-stock proceed numerous, fine, brownish-black, thread-like, root-fibres. It is liable to be confounded with the root of other ferns; and this is probably the cause of the discrepant opinions entertained of its properties. It is most generally confounded with the *Pteris aquilina* and *Aspidium* (*Athyrium*) *Filix-fœmina.* The root-stock of the former of these is thinner than that of the officinal fern, branched, and black externally; and it presents the appearance of a cross or the letters I C, when cut obliquely. The latter has a short perpendicular root-stock, black externally, with black root-fibres; and the tufts or bases of the leaf-stalks, which compose the greater part of it, form a very acute angle with its axis, while those of the male shield fern extend outwards at a more open angle. The *Nephrodium dilatatum*, or *Lastræa dilatata*, which is also sometimes mistaken for the officinal species, has doubly-pinnate leaves; and the teeth of the leaflets end in a fine, capillary point.——The root of the male shield-fern should be collected, according to Peschier, between the end of May and the middle of September. At an earlier period the tufts are watery, possess little odour, and become internally brown on being dried. On the other hand, as winter approaches, they become gradually thready, and without taste or smell. But during summer and early autumn they have a pistachio-green tint, which is retained after desiccation; their proper odour and taste are strongest; and they have been ascertained to be most energetic medicinally. The root, when collected for medical use, should be cleared of foreign matters, root-fibres, and old or decayed tufts, but without being washed. It should then be dried quickly and thoroughly in the open air without heat, and in the shade; those tufts, as well as the parts of the root-stock which are greenish internally, should alone be detached, and immediately reduced to powder; and the powder must be kept in well-closed bottles. The druggist's stock ought to be renewed annually, because in two years the best article becomes useless. The powder is pale greenish-yellow. If good in quality it has, like the fresh root, a peculiar earthy disagreeable odour,

and a nauseously-sweet taste, followed by some bitterness and astringency. A cooled decoction is rendered blue by tincture of iodine, and black by the salts of iron.

Chemical History.—The root has been often analyzed, namely by Gebhardt, Morin, Wackenroder, and Geiger, who agree for the most part in their results. It appears to contain 45 per cent of lignin, 7 to 10 of starch, about 22 of uncrystallizable sugar, about 10 of gum, with various salts, a little tannin and volatile oil, about 7 of fixed oil, and 4 of resin. Its active part is probably the oil. This, as usually extracted by agitating the powder with ether and expelling the ether from the filtered solution by distillation, is greenish, thick, of a peculiar odour, and of a nauseous, bitterish, somewhat acrid taste; and it always contains a little volatile oil and some resin. The largest quantity of this oleo-resinous matter is obtained from roots collected between the end of May and middle of September (Peschier); and the oil is obtained most free of resin by using the purest ether.

Actions and Uses.—The only property of the male shield-fern which has hitherto attracted attention is its action as a vermifuge. Though used as such by the Greeks, it had been long almost abandoned, when Peschier lately fixed the conditions for securing its activity, as detailed above, and proved that it is an energetic remedy, especially in tænia, the most obstinate kind of intestinal worm. As an indigenous anthelmintic it merits more attention than it has yet received in this country; because, of the two remedies now in vogue, turpentine-oil and pomegranate root-bark, the former is peculiarly nauseous and often inconvenient in its effects, while the latter can seldom be obtained in its fresh and most active state. The best preparation is the resinous oil extracted by ether. This is given in the dose of 18 grains at night, and again in the morning, in the form of pill or emulsion, or dissolved in castor-oil; and a laxative draught of castor-oil is administered two hours after the second dose. The worms are discharged dead. Peschier, when his paper was published, had known this treatment successful in 150 cases near Geneva, and says it never failed. Ullersberger has more recently confirmed this statement,—observing that he had used the remedy in 60 cases, and a medical friend in 200, with invariable success. He adds that the death of the worm, which happens in two hours, is attended with sickness and severe griping; and that, after the administration of a dose of calomel and jalap, followed by sulphate of magnesia, the worm is discharged in one mass. In Paris it has not proved so effectual; which Mérat thinks may be owing to its being better adapted for the tape-worm of Switzerland than the *Tænia lata*, the most frequent variety in the French capital. I have used it successfully in the only case I have lately met with in Edinburgh.—The root of this fern has been sometimes used for tanning; and its ashes, as they yield much carbonate of potash, may be applied to various economical purposes.

The usual dose of the root is a drachm, according to Peschier, but three or four drachms according to Ullersberger.

FOENICULUM. *Fruit of Fœniculum officinale, Allioni, Flor. Ped.* (*Edin.*) *Fruit of Fœniculum vulgare, DC.* (*Lond.*) *Seeds of Anethum Fœniculum, L.* (*Dub.*) *Fennel.*

AQUA FOENICULI.

PROCESS, *Edin. Lond.* To be prepared in the same way as Aqua Anethi.
PROCESS, *Dub.* Take of
Fennel, bruised, one pound;
Water, enough to prevent empyreuma;
Distil off a gallon.

OLEUM FOENICULI.

PROCESS. To be prepared from the fruit of Fœniculum officinale (vulgare, L.—dulce, D.) according to the instructions for Volatile oils. See *Introduction.*

FOR. NAMES.—*Fren.* Fenouil.—*Ital.* Finocchio.—*Span.* Hinojo.—*Port.* Funcho.—*Ger.* Fenchel.—*Dut.* Venkel.—*Swed.* Fenkol.—*Dan.* Fennikel.—*Russ.* Ukrop voloschkoi.—*Arab.* Razeeanuj.—*Pers.* Badeeyan.—*Tam.* Perun siragum.—*Hind.* Mayuri: Sonf.

FIGURES of Fœniculum vulgare as Anethum Fœniculum in Nees von E. 277.—Hayne, vii. 18.—Steph. and Ch. iii. 137.

FENNEL is supposed to have been the Μαραθρον of Dioscorides.

Natural History.—There is some confusion as to the true botanical source of officinal fennel. It belongs to the Natural family *Umbelliferæ* of Decandolle, or *Apiaceæ* of Lindley, and to the Linnæan class and order *Pentandria Digynia.* Linnæus arranged it in the genus *Anethum*, and Sprengel in that of *Meum*, while Decandolle, who has been followed by most botanists of the present day, has erected it with a few other species into a distinct genus under the name of *Fœniculum.* By some the officinal species is considered to be the *Fœniculum vulgare* or common fennel; others regard it as a variety of this species, and term it *Fœniculum vulgare*, var. *dulce;* while others view it as a distinct species under the name of *F. officinale* (Allioni), or *F. dulce* (Casp. Bauhin.—*DC.*) *F. vulgare* is a common biennial or perennial on sandy or chalky soils in this country, as well as on the Continent. It is between three and four feet high, produces tripli-pinnate leaves with threadlike leaflets, and bears an ovate fruit, each half of which is plano-convex, of a brown colour, scarcely two lines long and one broad, of a peculiar fragrance when bruised and moistened, and of a pleasant aromatic slightly sweetish taste, approaching that of anise. I apprehend that this fruit constitutes a part of the fennel of English druggists, and that it is often sold as Sweet-fennel. *F. officinale* (Allioni), indigenous only in the south of Europe, is very like *F. vulgare;* but its leaves are less, the leaflets shorter, and the fruit paler, at least one-half longer, and twice as heavy, often curved, and of a sweeter and more agreeable taste. This sort of fennel is sometimes met with in the shops of nurserymen in Britain under the name of Florence seed; but I have seldom seen it in the hands of

druggists in this city. Identical probably with the foregoing is the *F. dulce* of Decandolle, Lindley, and others, which some however describe as a distinct species, and as the real source of genuine Sweet-fennel or Florence-fennel, the Finocchio dolce of the Italians. This species is a native of Italy and other parts of southern Europe, as well as of the Canary Isles. Mérat says it is an annual plant; but in other respects his description corresponds substantially with that which he likewise gives of *F. officinale*. I have lately found in the shop of a seedsman, under the name of Florence-seed, a still larger fruit, nearly thrice as long and above three times as heavy as *F. vulgare*, and of the same strong aromatic sweetness as *F. officinale*, but agreeing in all its characters with the fruit of *F. Panmorium* sent to me from Calcutta. The account given by Dr Pereira of the fennel of druggists is somewhat different from that given in the present work. He says the fruit of *Fœniculum vulgare* is never used for officinal fennel, and that two varieties of Sweet fennel are employed, called in trade, from their respective length, Shorts and Longs, the latter of which is preferred. I cannot at present account for the difference between our observations, except by supposing that a difference exists in the practice of druggists in England and Scotland. The three British Pharmacopœias all disagree in their botanical references for fennel. The London College adopts *F. vulgare*, that of Edinburgh *F. officinale*, and that of Dublin, while admitting into its Materia Medica only the former of these under its prior name of *Anethum Fœniculum*, also really adopts *F. dulce*, as this plant is directed to be used for making fennel-oil.

Chemical History.—Fennel imparts its aroma to water and alcohol; and both carry the aroma over with them when distilled from it. Like other umbelliferous aromatic fruits, it is composed of volatile oil, fixed oil, resin, and other less important ingredients. The volatile oil, its active part, is pale-yellow in colour, 997 or 999 in density, crystallizable at 50°, and possessed of the peculiar taste and odour of the fruit. Its stearoptin or crystallizable part is identical in elementary composition with that of anise; but the oil itself is somewhat different, as it consists of 13 equivalents of carbon, 8 hydrogen, and 2 oxygen (Blanchet and Sell).

Actions and Uses.—Both the fruit and its volatile oil are tonic, stomachic, and carminative in their action. Caraway and anise however have in a great measure displaced them in this country. The blanched leafstalks of sweet-fennel are used in Italy for the same dietetic purposes with those of celery in Britain, and its fruit is one of the most familiar aromatics of the Italians. Officinal fennel is used for preparing the *Spiritus juniperi compositus* and *Confectio* (*Electuarium*, E.) *piperis* of the three Pharmacopœias, and the *Decoctum chamæmelæ compositum* of the Dublin College; and all the Colleges have also its distilled water and volatile oil.

The doses of its preparations are *Fœniculum*, E. L. *Anethi Fœ-*

niculi semina, D. dr. ss. ad dr. ii.—*Aqua fœniculi* fl. unc. i. ad. fl. unc. iv.—*Oleum fœniculi* (*dulcis*, D.), min. ii. ad min. x.

FRAXINUS ORNUS, *D.* See *Manna*.

FUCUS VESICULOSUS, *D.* *The Herb and Fruit of Fucus vesiculosus, Linn.*——*Bladder-wrack.*

DIFFERENT species of sea-weed have been used in medicine from a remote period. The present species, which abounds upon the rocky coasts of this island, is one of the best sort for making kelp, and it constitutes an excellent manure. In seasons of scarcity it is sometimes used for fodder by the inhabitants of the northern and western islands of Scotland. Medicinally, its expressed juice has been recommended internally and externally for local strumous affections; and its charcoal, under the name of *Aethiops vegetabilis*, long enjoyed considerable celebrity as a remedy both for these diseases and for bronchocele. It is probable that any such medicinal properties which the plant or its charcoal may possess, are owing to the small quantity of iodine now known to enter into their composition; and for this and other reasons the Bladder-wrack has been for some time entirely abandoned in medicine.

In recent times, another species, the *Fucus endiviæfolius*, of Lightfoot, or *Chondrus crispus* of Greville, Lindley and others, now familiar in the shops under its Irish name of Carrageen, has been strongly recommended as a nutritive and restorative article of food. This is a common weed on our coasts. When dry it has a pale grayish-yellow colour and horny texture, and is known from other plants of the Natural family *Algæ* by the twisted, curly appearance of the segments of its fronds. It consists chiefly of a vegetable jelly (Herberger), which,—as it is not affected in solution by alcohol, tincture of iodine, infusion of galls, or acetate of lead,—differs from the jellies of gum, starch, gelatin, or pectin, and has been therefore held by Dr Pereira to be a peculiar principle, and called by him Carrageenin. It also contains a notable proportion both of iodine and bromine and a large amount of sulphate of soda (Dupasquier). The gelatinous principle is easily dissolved out by boiling water; and if the sea-weed be first macerated for a few minutes in cold water, and then boiled for a quarter of an hour in about a hundred times its weight of water, the strained decoction becomes, when cold, a firm, nearly tasteless jelly, which forms with sugar and aromatics a palateable article of diet. Carrageen-jelly thus prepared may be employed alternately with other light jellies, to humour the fickle tastes of patients upon low diet; but it is absurd to speak of it as a tonic, nutritive, and restorative remedy in the extravagant terms used by some.

GALBANUM, *E. L. D.* *Concrete gummy-resinous exudation of an imperfectly ascertained umbelliferous plant, probably a species of Opoïdia, Lindley, Bot. Reg.* 1839 (*Edin.*)—*of Galbanum officinale, Don. Lin. Trans.* xvi. (*Lond.*)—*of Bubon Galbanum, L.* (*Dub.*)—*Galbanum.*

EMPLASTRUM GALBANI, L. D.

PROCESS, *Lond.* Take of
Galbanum, eight ounces;
Litharge-plaster, three pounds;
Turpentine, ten drachms;
Common frankincense, triturated, three ounces.
Melt the galbanum and turpentine together; add the frankincense, and then the plaster, previously fused with a gentle heat; mix them thoroughly.

PROCESS, *Dub.* Take of
Litharge-plaster, two pounds;
Galbanum, half a pound;
Yellow-wax, sliced, four ounces.
Having melted the galbanum, add the wax and litharge-plaster; then melt them together with a moderate heat and strain the mixture.

EMPLASTRUM GUMMOSUM, E. See *Ammoniacum.*
PILULAE GALBANI COMP. L. D. See *Assafœtida.*

TINCTURA GALBANI, D.

PROCESS, *Dub.* Take of
Galbanum, in small fragments, 2 ounces;
Proof-spirit, two pints, (old m.)
Digest for seven days, and then filter.

FOR. NAMES.—*Fren. Ger. Dut. Swed.* and *Dan.* Galbanum.—*Ital. Span.* and *Port.* Galbano.—*Russ.* Galban.—*Arab.* Barzud.—*Pers.* Beerzud.—*Hind.* Bireeja.

Galbanum officinale not yet figured.

GALBANUM, one of the fetid gum-resins, has been long used in medicine, being described by Dioscorides under the name of χαλβάνη.

Natural History.—Its botanical source is not yet accurately known. It was for some time generally referred to the *Bubon Galbanum*, a native of various parts of Africa. Lobel referred it to the *Ferula Ferulago*, a species of the same genus which furnishes assafœtida, and a native of northern Africa as well as the south of Europe. It has been described as produced, like assafœtida, by cutting over the stem close to the root, and collecting the juice which flows from the latter and concretes upon it. Mr David Don however has justly remarked of these species, that galbanum can scarcely be supposed to be the product of a plant, no part of whose organization exhales an odour like that of the drug. And he has been led to conclude, from an examination of seeds contained in specimens of the gum-resin of commerce, that it is derived from an entirely new species belonging to a distinct genus; and he assigns to the plant the name of *Galbanum officinale.* The London College has followed his authority; but without sufficient reason, for the evidence adduced is the very same which, as Mr Don himself has ably shown, misled Willdenow in his attempts to determine the true source of ammoniac. More lately Sir John M'Neill sent to England specimens of a plant from Durrood in Khorasan, which was supposed to yield a kind of ammoniac, and upon which a pale-yellow waxy gum-resin adhered, having a close resemblance to commercial galbanum. On examining this plant

Professor Lindley found it to be a species belonging to an entirely new umbelliferous genus; and he has therefore called it *Opoïdia balsamifera*. It is possible that this or an allied species may yield galbanum.

Galbanum is brought to Europe partly from the Levant, and partly from India. Like the other fetid gum-resins, it is met with in the shops sometimes in tears, and sometimes in masses of agglutinated tears. The tears are globular, oval or irregular, pale yellowish-brown, translucent, softer and tougher than the other gummy-resinous tears, pulverizable only in very frosty weather, of a strong, peculiar odour, and of a bitterish, disagreeable, somewhat acrid taste. In consequence of their softness at ordinary temperatures, the tears are commonly united into lumps. But another variety of galbanum in lumps is an inferior sort, consisting of tears united together by an agglutinating material. This kind is softer, darker in colour, opaque, less powerful in odour, more bitter and less acrid in taste. The coarser qualities of lump-galbanum present few or no tears, a brown colour, a weak odour, considerable viscosity, and an evident admixture of sand, straws, chips of wood, and other impurities.

Chemical History.—Galbanum loses its qualities with its odour by long exposure to the air, and is therefore best preserved in bladders. Heat softens, but does not melt, it. When thrown upon live coals, it burns with a white flame and emits a rather fragrant odour. Water converts it into an emulsion through means of the gum contained in it. Proof-spirit dissolves it almost entirely; but rectified spirit leaves some gum; and hence the former is correctly preferred by the Dublin College for making the *Tinctura galbani.* The tincture forms an emulsion on being thrown into water. Sulphuric ether dissolves the whole resin and volatile oil, leaving all the gum. According to the analysis of Meissner, with which that of Pelletier essentially corresponds, galbanum is composed of 66 per cent of resin, 22.6 soluble gum, 1.8 bassorin, 3.3 volatile oil, with a trace of malic acid, and some impurities. The volatile oil, which is yellowish, concentrates in itself the whole odour of the gum-resin. This oil must not be confounded with a blue oil mentioned by some writers, which is got in large quantity by distilling galbanum alone at a temperature about 256°.. The yellow odoriferous oil is obtained only by distillation with water.

Actions and Uses.—The properties of galbanum in relation to the animal body are much the same with those of assafœtida; but it is less energetic. It is a diffusible stimulant and antispasmodic, a diaphoretic, emmenagogue and carminative. At present however it is very little used internally except in conjunction with other drugs of similar and more energetic virtues, as in the assafœtida pills of the Edinburgh College, and the compound galbanum pills of the Colleges of Dublin and London. It seems to hold a middle place in point of activity between assafœtida and ammoniac. It is

more used externally, because, from its consistence and stimulant properties together, it forms a convenient addition to most stimulating plasters. The tincture, applied at intervals by means of pledgets upon the closed eyelids, has been held to be a useful remedy in scrophulous ophthalmia, and irritability or weakness of the eyes occasioned by over-exertion of them (Arnold).

The doses of the preparations of galbanum are *Galbanum*, E. L. D. gr. x. ad gr. xx. repeatedly. *Tinctura galbani*, D. fl. dr. i. ad fl. dr. ii. *Pilulæ galbani compositæ*, L. D. gr. x. ad gr. xx. thrice a-day. *Pilulæ assafœtidæ*, E. gr. x. ad gr. xx. thrice a-day. *Emplastrum galbani*, L. D., and *Emplastrum gummosum*, E. externally.

GALLAE. *Excrescences of Quercus infectoria, W. Spr.; formed by Diplolepis Gallæ tinctorum, Ollivier, Voy. (Edin.) Diseased buds of Quercus infectoria (Lond.) From Quercus infectoria (Dub.)—Galls.*

TINCTURA GALLARUM, E. D. TINCTURA GALLAE, L.

PROCESS, *Edin.* Take of
Powder of Galls, two ounces;
Proof-spirit, one pint.
This tincture may be made either by digestion or percolation, as directed for tincture of capsicum.

PROCESS, *Lond.* Take of
Galls, bruised, five ounces;
Proof-spirit, two pints.
Macerate for fourteen days, and strain.

PROCESS, *Dub.* Take of
Powder of Galls, four ounces;
Proof-spirit, one (old-wine) pint.
Macerate for seven days, and strain.

UNGUENTUM GALLARUM, D.

PROCESS, *Dub.* Take of
Galls, in very fine powder, an ounce;
Prepared axunge, four ounces.
Mix them into an ointment.

UNGUENTUM GALLAE COMPOSITUM, L. UNGUENTUM GALLAE ET OPII, E.

PROCESS, *Edin. Lond.* Take of
Galls, in very fine powder, two drachms;
Opium, in powder, a drachm (hard opium in powder, half a drachm, L.);
Axunge, an ounce, (two L.)
Triturate them well together.

FOR. NAMES.—*Fren.* Noix de galle.—*Ital.* Galla; Gallozza.—*Span.* Agallas de Levante.—*Port.* Galhas.—*Ger.* Galläpfell.—*Dut.* Galnoot.—*Swed.* Galläplen.—*Dan.* Galaebler.—*Russ.* Fschernilnoie orechi.—*Arab.* Afis.—*Pers.* Mazu.—*Tam.* Machakai.

FIGURES of Quercus infectoria in Nees von E. 94.—Hayne, xii. 45.—Steph. and Ch. iii. 152.

GALLS were known to the Romans by their present officinal name, and were thought to be the fruit of a species of oak.

Natural History.—Several species of oak, inhabiting Europe and Western Asia, produce excrescences similar in origin and analogous in nature to the galls of European commerce. Other genera of plants likewise yield products of the same kind, among which may be mentioned the genus *Tamarix*, and particularly the *T. orientalis.* But it was proved by the Levant traveller, Ollivier, about the beginning of this century, that officinal galls are obtained chiefly or solely from the *Quercus infectoria,* which he was the first to distinguish accurately and name. This is a small tree or shrub about six feet in height, belonging to Decandolle's Natural family

Amentaceæ, to the *Corylaceæ* of Lindley, and to the Linnæan class and order *Monœcia Polyandria.* It abounds throughout Asia-Minor, and especially along its Mediterranean coasts. The young twigs of the plant are very subject to be pricked by an insect, the *Diplolepis gallæ-tinctorum* (*Cynips quercus-folii, Lin.*), for the deposition of its eggs; round which the juices of the tree are freely secreted, and, concreting as they flow, form the hard excrescences termed Galls. Towards the end of July, the young insect, having passed through all its stages of transformation into the state of fly, perforates its prison and escapes. As galls are finest in quality just before the escape of the insect, they are commonly gathered about the middle of July.

Those in greatest estimation are called Aleppo galls from their commercial source. East-India galls, which are imported from Bombay and are probably obtained in Persia, are also often of fine quality. Both sorts consist of two kinds, termed in trade Blue and White galls. Galls vary in size from that of a large pea to that of a small walnut. They are roundish, tuberculated on the surface, and hollow within; and sometimes they retain the short stalk by which they adhered to the tree. Blue-galls, which are gathered before the escape of the insect, have a dark grayish-green, or dirty pale-bluish colour, considerable weight and hardness, a somewhat shining surface, and a close, firm, resinous-like texture. The hollow in the centre is small, and contains, sometimes only dust and debris in consequence of the insect having perished, but more commonly the insect itself in the state of larva, pupa, or most generally of fly, which is occasionally seen to have partly perforated the parietes of the excrescence. White galls have a yellowish-white colour, a duller surface, fewer tuberosities, less weight, and less closeness of texture than the blue variety, also a larger cavity, and a perforation about the size of a large pin-head, by which the insect had escaped, or in which it is sometimes found entangled. Both kinds are brittle and may be reduced without difficulty to a pale yellowish-gray powder. They have an intensely astringent taste, with scarcely any bitterness, and are without odour. The best are those of middle size, dark, heavy, and unperforated; and the palest and lightest are always the worst.

Chemical History.—Galls part with their astringency to water, alcohol, proof-spirit, and ether. Water is the most powerful solvent, and next to it proof-spirit; the latter makes a dark-red tincture, the *Tinctura gallæ* of the Pharmacopœias. Pure alcohol and ether act more feebly. Galls, according to the analysis of Guibourt, consist of 65 per cent of tannin, 10.5 of fibre, 11.5 of moisture, 5.8 of gum, sugar, and starch, 4.0 of gallic, ellagic, and luteo-gallic acids, together with extract, chlorophyll, volatile oil, albumen, and salts. It is upon the tannin which they contain that the properties of galls essentially depend.

As the tannin of galls is usually considered the type or most perfect form of this principle, a short account of its properties may be given in the present place. It is most easily obtained in a state of purity by exposing powder of galls for several days to a very moist atmosphere,—soaking it for twenty-four hours in a bottle with just enough of ether to moisten it,—expressing the pulp in a powerful press,—repeating a second time the maceration with ether and the expression,—recovering as much ether as possible by distillation,—and evaporating what remains from the residuum over the vapour-bath. I have easily obtained sixty per cent in this way. When thus prepared, tannin is colourless or pale-yellowish, shining, spongy, easily pulverizable, and intensely astringent, without any bitterness. It undergoes a kind of semifusion when moderately heated. It is sparingly soluble in ether, much more so in alcohol or proof-spirit, and most of all in water. The last menstruum forms a nearly colourless solution, which reddens litmus, decomposes alkaline carbonates with effervescence, and unites with bases to form salts. Tannin therefore possesses acid properties, and indeed is now often denominated tannic acid. Nevertheless a concentrated solution of it is precipitated by various acids, such as muriatic, nitric, phosphoric, and arsenic acids. Its solution causes a deep bluish-black precipitate with the salts of sesquioxide of iron. This is tannate of iron, the basis of writing ink. Other forms of tannin, such as that from catechu or kino, occasion with the same salts a precipitate of a dark greenish-black colour. Gall-tannin in solution causes a curdy precipitate with solution of gelatin, and it also unites with that principle as contained in the solid state in the texture of skin,—an action which constitutes the foundation of the process of tanning leather. Solution of tannin produces with the salts of all vegetable alkaloids insoluble precipitates, which are tannates of the organic bases thrown down. When its solution is exposed to air or oxygen gas for a length of time, gallic acid is formed, and assumes the appearance of a gray crystalline powder (see *Supplement*). Tannin, according to the analysis of Liebig, is composed of 18 equivalents of carbon, 8 hydrogen, and 12 oxygen ($C^{18}H^{8}O^{12}$), or per cent 51.79 carbon, 4.12 hydrogen, and 44.09 oxygen.

Adulterations.—Various adulterations of galls have been noticed by continental authors; but they are little practised in English trade. Sometimes white galls are made to imitate the superior blue sort by exposing their surface to a solution of sulphate of iron. This fraud is discovered by means of muriatic acid, which removes the adventitious, and restores the original, hue, but has scarcely any effect on genuine blue galls. Sometimes counterfeit galls are made by mixing little balls of clay with them. The only good criterion of quality in the powder is the proportion of tannin removable by sulphuric ether.

Actions and Uses.—Galls are astringent in their action; and all their medicinal applications rest upon this property. Like other

vegetable astringents, they have been held to possess febrifuge virtues in ague. They are useful in the chronic stage or form of dysentery and diarrhœa, occasionally too in gleet, and sometimes in hæmorrhagies of the passive kind. But for such purposes kino and catechu are now commonly preferred, probably without any sufficient reason. Galls constitute the best antidote for poisoning with tartar-emetic. The most convenient form for internal use is the tincture diluted with water and sweetened with syrup; or an infusion may be substituted; or an extract in the form of pill. As a local application an infusion of galls is sometimes employed for an injection in gleet, or for a gargle in indolent ulceration of the fauces, relaxed uvula, and the chronic stage of the effects of mercury on the mouth. In the form of the Dublin *Unguentum gallarum*, or the London *Unguentum gallæ compositum*, or still better in that of the stronger Edinburgh *Unguentum gallæ et opii*, powder of galls is an esteemed topical application for external hæmorrhoids, especially in old persons or relaxed constitutions. The Dublin College uses no opium in this preparation; the formula of the London College directs too small a proportion of galls, and much too little opium. Galls in the form of tincture or infusion constitute an important reagent in pharmacy, as for detecting iron, gelatin, the vegetable alkaloids, &c. Tannin, in the dose of three, four, or six grains several times a-day, has been lately found a powerful astringent in hæmorrhagies, and in chronic dysentery and diarrhœa.

The doses of the officinal preparations of galls are, *Gallæ*, gr. v. ad scr. i. *Tinctura gallarum*, fl. dr. ss. ad fl. dr. ii. *Unguentum gallarum*, D. *Unguentum gallæ et opii*, E. *Unguentum gallæ compositum*, L. externally.

GENTIANA, *E. L. D.* *Root of Gentiana lutea, L. W. Spr.*

Infusum Gentianae, E.

Process, *Edin.* Take of
Gentian sliced, half an ounce;
Bitter-orange-peel, dried and bruised, a drachm;
Coriander bruised, a drachm;
Proof-spirit, four fluidounces;
Cold water, sixteen fluidounces.
Pour the spirit on the solids; in three hours add the water; in twelve hours more, strain through linen or calico.

Infusum Gentianae Compositum, L. D.

Process, *Lond. Dub.* Take of
Gentian, sliced, and
Orange-peel dried, of each two drachms (one, D.)
Fresh lemon-peel, two drachms (one, D.)
Boiling (distilled, L.) water, a pint, (twelve ounces, D.)
Digest for an hour in a covered vessel, and strain.

Extractum Gentianae, E. L. D.

Process, *Edin.* Take of
Gentian, any convenient quantity;
Bruise it to a moderately fine powder; mix it thoroughly with half its weight of distilled water; in twelve hours put it into a percolator, and exhaust it by percolation with temperate distilled water. Concentrate the liquid; filter it before it becomes too thick, and evaporate in the vapour-bath to the due consistence.

Process, *Lond.* Take of
Gentian sliced, two pounds and a half;
Boiling distilled water, two gallons;
Infuse for twenty-four hours; boil down to a gallon; strain while hot; and concentrate to the due consistence.

Process, *Dub.* Take of
Gentian-root, any convenient quantity;
Boil it in eight times its weight of water down to one-half; express the decoction; and let it settle, and strain it. Evaporate over the vapour-bath to the due consistence, stirring constantly.

MISTURA GENTIANAE COMPOSITA, L.

PROCESS, *Lond.* Take of
Compound infusion of gentian, twelve fluidounces;
Compound infusion of senna, six fluidounces;
Compound tincture of Cardamom, two fluidounces;
Mix them.

TINCTURA GENTIANAE COMPOSITA, E. L. D.

PROCESS, *Edin.* Take of
Gentian, sliced and bruised, two ounces;
Dried bitter-orange-peel, bruised, an ounce;
Canella, in moderately fine powder, half an ounce;
Cochineal, bruised, half a drachm;
Proof-spirit, one pint and sixteen fluidounces.
Digest for seven days; strain and express strongly; and then filter the liquor. This tincture may be more conveniently prepared by percolation, as directed for the compound tincture of cardamom.

PROCESS, *Lond. Dub.* Take of
Gentian, sliced, two ounces and a half (two ounces, D.)
Dried orange-peel, ten, (eight, D.) drachms;
Cardamom, bruised, five drachms, (without capsules, four drachms, D.)
Proof-spirit, two (old-wine, D.) pints.
Macerate fourteen days and strain.

VINUM GENTIANAE COMPOSITUM, E.

PROCESS, *Edin.* Take of
Gentian, in coarse powder, half an ounce;
Yellow-bark, in coarse powder, one ounce;
Bitter-orange-peel, dried and sliced, two drachms;
Canella, in coarse powder, a drachm;
Proof-spirit, four fluidounces and a half;
Sherry, thirty-six fluidounces;
Digest the root and bark for twenty-four hours in the spirit; add the wine and digest for seven days more; strain and express the residue strongly; and filter the liquors.

FOR. NAMES.—*Fren.* Gentiane.—*Ital.* Genziana.—*Span.* and *Port.* Genciana.—*Ger.* Enzian.—*Dut.* Gentiaan.—*Swed.* Baggsöta.—*Dan.* Sode; Sodrod.—*Russ.* Gentsiana; Goretschavka gelmaia.

FIGURES of Gentiana lutea in Nees von E. 199.—Hayne, xiii. 28.—Steph. and Ch. iii. 132.

GENTIAN was known to the ancient physicians, being the Γεντιανη of the Greeks. Dioscorides traces its name to an Illyrian king, Gentis, who was thought to have been the first to discover its properties.

Natural History.—The *Gentiana lutea*, the plant which produces it, belongs to the Linnæan class and order *Pentandria Digynia*, and to Decandolle's natural family *Gentianeæ*, or *Gentianaceæ* of Lindley. It is an inhabitant of alpine grassy slopes and meadows throughout the middle regions of continental Europe, and abounds in the Pyrenees, the mountains of Vosges and Auvergne, and the Alps of Austria and Switzerland. It thrives best at elevations between three thousand and five thousand feet above the sea, and is particularly abundant on Mount Jura. It has an annual herbaceous hollow stem, three or four feet high, which becomes covered in July with splendid yellow flowers. Its root is perennial, branchy, towards an inch or even more in thickness when some years old, between two and four feet long, ringed and wrinkled, brown externally, and yellow within. The root is its only officinal part; but the whole plant possesses more or less the same properties. The root is imported into this country from Switzerland and the south-west of France by way of Marseilles and other French ports (Pereira). It is in pieces commonly a few inches long, seldom above

an inch in thickness, and split lengthways if large. It consists of three layers,—the outer ones reddish-yellow and separated by a dark reddish-brown line, and the centre grayish-yellow and spongy. It is tough and flexible when not quite dry; but when thoroughly dried it is easily reduced to a yellowish-brown powder. It has a feeble aromatic odour, and a taste first faintly sweetish, and then purely, intensely, and permanently bitter.

Chemical History.—It imparts its bitterness readily to water, cold or hot, to alcohol, spirit, wine, or sulphuric ether. Water, proof-spirit, and wine are therefore used for making the officinal *Infusum, Tinctura,* and *Vinum gentianæ.* The tincture is most conveniently made by percolation, as directed by the Edinburgh College. The extract may be variously prepared. That obtained from an infusion is superior in quantity, bitterness, and aroma to the Dublin extract from a decoction (Cadet de Vaux); but it is still finer when made, according to the directions of the Paris Codex of 1837 and the Edinburgh Pharmacopœia, from a solution got by percolation with cold water and evaporated without boiling. An infusion ferments with yeast, and the product yields a bitter distilled spirit, which is prized in some parts of Switzerland as a stomachic. Gentian consists of bitter extractive matter, gum, uncrystallizable sugar, a principle analogous to birdlime, concrete oil, a yellow colouring principle, a trace of volatile oil (Henri and Caventou), and a peculiar acid named Gentisic acid (Leconte). Henri and Caventou thought they had succeeded in separating, by means of ether, an active neutral crystalline principle of a yellow colour, in which the bitterness of the root is concentrated. But Leconte has more lately shown that these crystals are impure gentisic acid; and that when quite free of impurities, they are without bitterness, nearly colourless, feebly soluble in water, alcohol, and ether, and feebly, yet distinctly, acid in their relations to vegetable colours and to bases. Trommsdorff has also arrived at similar results. The active principle has not yet been isolated.

Adulterations.—Gentian is said by continental pharmacologists to be often adulterated. The admixture of the roots of other species of gentian, such as *G. purpurea, punctata,* and *Pannonica,* inhabitants mostly of the same localities with *G. lutea,* is probably frequent, but seems of no great consequence, because they are equally bitter, and the properties of all the gentians are the same in kind. The root of *G. purpurea* is simple, yellow externally, and dark-brown (whitish, Hayne) within. That of *G. pannonica* is less distinctly ringed than yellow gentian, whitish internally, and yellowish-brown on the surface. That of *G. punctata* being bright yellowish-brown in its substance, it is scarcely distinguishable from officinal gentian, and is indeed often used as a substitute on the continent, especially in Moravia. The roots of monkshood, belladonna, and white hellebore, are sometimes mixed with gentian;—a serious adulteration, because all these roots are eminently poison-

ous. They are easily distinguished however with ordinary care; because none of them are yellow internally, or possess the pure intense bitterness of gentian,—the taste of monkshood and belladonna being feebly bitter, while that of white hellebore, though strongly so, is likewise acrid and nauseous.

Actions and Uses.—Gentian is powerfully tonic in its action; and therefore it is, like most bitters, febrifuge and stomachic. It is also in some measure antiseptic; it is no mean anthelmintic; and many ascribe to it laxative properties. Large doses are apt to cause vomiting. It is absorbed, and when taken for a long time imparts bitterness to the secretions. It was at one time much employed in ague, especially along with astringents and aromatics. It continues to be one of the most esteemed bitter stomachics in the forms of dyspepsia unconnected with inordinate irritability of the stomach, and is much taken by those who have weakened their digestion by the practice of indulgence at table. It is a good general tonic in all states of exhaustion from chronic diseases. It was once thought to possess the power of arresting the gouty paroxysm, as well as eradicating the disease from the constitution; and it formed a material part of a once celebrated remedy, the Portland powder. Its vermifuge virtues it possesses in common with other pure bitters. Its officinal preparations supply a sufficient variety of forms for use. They are generally taken several times a-day half an hour before meals.

The doses of its preparations are: *Gentiana*, gr. x. ad gr. xxx. *Extractum gentianæ*, gr. x. ad ser. i. *Infusum gentianæ*, E. fl. unc. i. ad fl. unc. ii. *Infusum gentianæ compositum*, L. D. fl. unc. i. ad fl. unc. ii. *Mistura gentianæ composita*, L. fl. unc. i. ad fl. unc. ii. *Tinctura gentianæ composita*, fl. dr. i. ad fl. dr. ii. *Vinum gentianæ compositum*, E. fl. dr. iv. ad fl. unc. i.

GEOFFROYA INERMIS, *D.* *Bark of Geoffroya inermis Willd.* (*Dub.*) *Cabbage-tree Bark.*

DECOCTUM GEOFFROYÆ, D.

PROCESS, *Dub.* Take of Geoffroya-bark, bruised, an ounce; Water, two pounds. Boil down to one pound; and add to the strained liquor two ounces of Syrup of Orange.

FOR. NAMES.—*Fren.* Ecorce de geoffrée.—*Ger.* Jamaicanische wurmrinde.—*Swed.* Maskbark.—*Dan.* Jamaikansk Ormbark.

FIGURES of Geoffroya inermis in Nees von E. 338.—Steph. and Ch. iii. 144.—Of Geoffroya Surinamensis in Nees von E. 339.

THE CABBAGE-TREE BARK was introduced into European practice as an anthelmintic about the middle of last century. It is derived, as was first shown by Dr Wright, from the *Geoffroya inermis* of Jamaica, now more generally known as the *Andira inermis* of Kunth, Decandolle, Lindley and others. This is a tree of con-

siderable size, belonging to the Natural family *Leguminosæ*, and to the Linnæan class and order *Diadelphia Decandria.* The bark has a mawkish, rather bitter táste. It contains a crystalline, neutral, azotiferous principle, intensely bitter, and capable of exciting purging in the dose of two grains (Huttenschmidt). This being its active ingredient, it has been absurdly enough called Jamaïcin. The bark is emetic and purgative, and is also thought by some to be a dangerous narcotico-acrid in large doses. It is a good anthelmintic, especially, as it would appear, in lumbricus; but it causes troublesome sickness, generally purging, and sometimes delirium; and consequently it is now abandoned in European practice. The seed is said to possess similar properties, but to lose them when long kept,—a circumstance which may help to account for the disappointments experienced by some in using the bark also.——An analogous purgative anthelmintic bark is produced by another species, the *Andira retusa*, or *Geoffroya Surinamensis*, of Guiana. This seems more common on the continent of Europe than the former. It contains an analogous crystalline principle called Surinamin (Winckler.)

The dose of its officinal form, the *Decoctum Geoffroyæ*, D. is unc. ss. ad unc. ii. for an adult. When it occasions too great sickness and purging, warm water should be first given, then castor-oil, and finally opium.

GEUM URBANUM, *D.* *Root of Geum urbanum, L. W. DC. Spr.* *Common avens.*

For. Names.—*Fren.* Benoite; Racine giroflée.—*Ital.* Erba benedetta.—*Ger.* Nelkenwurz.—*Dut.* Nagelwortel.—*Swed.* Näglikerot.—*Dan.* Nellikerod.—*Russ.* Grebnik; Gravilat zvozditschnoi

Figures of Geum urbanum in Nees von E. 310.—Hayne, iv. 33.—St. and Ch. i. 36.

The root of this common indigenous plant is an old aromatic tonic and astringent remedy, now entirely abandoned in British practice. The plant belongs to the Linnæan class and order *Icosandria Polygynia*, and to the Natural family *Rosaceæ.* It abounds in all parts of this country, in woods and at the roots of hedges. The root, which is brown externally and reddish in substance, has a fragrance like that of cloves while fresh; and when dry, it has an astringent, bitter, somewhat aromatic taste. It contains tannin, a little resin, and a trace of volatile oil, which is probably most abundant in the fresh root (Trommsdorff). Formerly it was used in frequent doses of thirty or sixty grains as an astringent and tonic in chronic mucous discharges. Dr Pereira says it is employed in England for giving a clover-like flavour to ale.

GLYCYRRHIZAE RADIX, *E. L. D.* *Root (fresh, Lond.) of Glycyrrhiza glabra, L. W. DC. Spr.* *Liquorice-root.*

GLYCYRRHIZAE EXTRACTUM, *E.* *Extract of the root of Glycyrrhiza, &c.*

EXTRACTUM GLYCYRRHIZAE, E. L. D.

PROCESS, *Edin.* Cut liquorice-root into small chips, dry it thoroughly with a gentle heat, reduce it to a moderately fine powder, and proceed as for extract of Gentian; viz. by percolation with cold water, &c.

PROCESS, *Lond. Dub.* To be prepared from (fresh, L.) liquorice root in the same way as extract of Gentian; viz. by decoction, &c.

DECOCTUM GLYCYRRHIZAE, D.

PROCESS, *Dub.* Take of
Liquorice-root, bruised, 1½ ounce;
Water, a pound by measure.
Boil for ten minutes, and then strain.

TROCHISCI GLYCYRRHIZAE, E.

PROCESS, *Edin.* Take of
Extract of liquorice, and gum-arabic, of each six ounces;
Pure sugar, a pound.
Dissolve them in a sufficiency of boiling water, and then concentrate the solution over the vapour-bath to a proper consistence for making lozenges.

FOR. NAMES.—*Fren.* Réglisse.—*Ital.* Regolizia; Liquirizia.—*Span.* Regaliz; Orozuz.—*Port.* Alcacuz.—*Ger.* Süssholz.—*Dut.* Zoethout.—*Swed.* Lakritsrot.—*Dan.* Lakrits-*Russ.* Solodkovoi koren.—*Arab.* Ussulsooss.—*Pers.* Bikhmekeh.—*Tam.* Addimodium.

FIGURES of Glycyrrhiza glabra in Hayne, vi. 40,—Steph. and Ch. iii. 134,—as Liquiritia officinalis in Nees von E. 327.

LIQUORICE was known to the ancient physicians, the plant being understood to have been the Γλυκυρριζη of Dioscorides, and Glycyrrhizion of Pliny.

Natural History.—The root is obtained from a perennial, herbaceous plant, the *Glycyrrhiza glabra*, or *Liquiritia officinalis* of some botanists; which belongs to the Linnæan class and order *Diadelphia Decandria*, and to the Natural family *Leguminosæ* of Decandolle, or *Fabaceæ* of Lindley. It inhabits deep light soils in southern Europe, particularly in Spain, Italy, and the south of France. It is also met with in some parts of Austria. It is much cultivated in England for medicinal use, especially near Pontefract in Yorkshire, and at Micham in Surrey. It is propagated by planting layers of the root, and is fit for use in its third year of growth. It has a very long, creeping, succulent root about the thickness of the thumb; from which arise several stems, nearly simple, and between two and four feet high. The stems are covered with large, unequally-pinnate, yellowish-green, somewhat viscous leaves, and bear axillary, racemose, papilionaceous flowers, which are whitish, with purple tips, and are succeeded by smooth four-seeded pods. Another species, *G. echinata*, a native of southern Russia, and officinal in some Continental Pharmacopœias, (see figures in Nees von E. 328, and Hayne, vi. 41), is distinguished, among other characters, by the stem being less leafy, the leaves not viscous, the flowers almost capitate, and the pods two-seeded and covered with spines. The officinal part of *Glycyrrhiza glabra* is the root, which is partly imported into this country from the Continent, but is chiefly ob-

tained from plants cultivated in England. The latter kind is superior in quality, being smoother and thinner in its skin, and less generally injured by insects than the other. The London College directs it to be preserved fresh; which may be accomplished for many months by covering it with sand in a damp cellar. The root is plump, smooth, and juicy while fresh; but the dry root is wrinkled longitudinally, grayish-brown on the surface, so dense as to sink in water, yellow, fibrous, and tough in its substance, without odour, and of a strong, peculiar, persistent, sweet, subacrid taste. Its powder is brownish-yellow, or pale yellow if made of decorticated root, and more intensely sweet than the root in substance. The dry root must be kept in a very dry place, otherwise it is apt to spoil.

Chemical History.—Its active part is soluble both in water and in alcohol. A concentrated watery solution is acidulous. It yields a considerable grayish and sometimes gelatinous precipitate with acids, especially sulphuric acid; alcohol also throws down a precipitate from it; and solutions of the vegetable alkaloids quina, strychnia, and brucia, as well as infusion of opium, are decomposed by it (Zier). Water, being a good solvent for its active ingredients, is used for making the officinal *Decoctum* and *Extractum glycyrrhizæ.* The extract used in the shops is of two kinds. That which alone is recognized by the London and Dublin Colleges is a brown extract of the consistence for making pills, and is prepared in this country by druggists. But the Edinburgh College also recognizes, —inconveniently perhaps under the same name,—the Liquorice, Extract of liquorice, Sugar of liquorice, or Black sugar of commerce; which comes from abroad in the form of hard, black cylinders. Liquorice is prepared in Spain, Italy, and Sicily, from the root of *G. glabra* only (Guibourt), by inspissating the decoction in copper kettles till the mass is thick enough to become firm on cooling. It is then made up in sticks about six inches long, and dried with a covering of leaves of the *Laurus nobilis* or Sweet-bay; in which state it is imported into Britain. The finest comes from Italy. It is dark brownish-black, smooth, shining, tough and flexible when warm, brittle when cold, and of an intensely sweet taste, with scarcely perceptible acridity. Water slowly dissolves from three-fifths to eleven-twelfths of it, according to its quality. Alcohol dissolves about an eighth only, and acquires an acrid taste, while the residuum is purely sweet and entirely soluble in water (Dulk). Its most important ingredient is a peculiar sweet principle, to be noticed presently. The liquorice of commerce answers very well for making lozenges; but if used as an excipient for pills, or for sweetening decoctions and the like, it should be purified by preparing from it an extract of proper consistence, as is practised by many druggists in this country. Cold water answers best for the purpose, because it yields a finer extract than a decoction. The *Extract of liquorice* of the London and Dublin Colleges, which has also been adopted by the College of Edinburgh, is prepared in

Britain from liquorice-root of home growth. When of fine quality, it is of a brown colour, and possesses a pure sweet taste, without acridity, and more intense even then that of purified liquorice. The London College directs the fresh root to be used for making it; but the fresh has no advantage over the dry root, and is even said by Mérat to yield a more acrid preparation. Both the London and Dublin Colleges commence the process by making a decoction; but in this way too a more acrid extract is obtained. If the method of percolation be employed, as directed by the Edinburgh Pharmacopœia,—in accordance with the recent improvements in pharmaceutic chemistry, and with the example of the Parisian Codex,—the extract is obtained by means of cold water with greater facility, of finer quality, and in the large proportion of between 50 and 58 per cent (Geiger). The root of *Glycyrrhiza echinata* yields only 40 per cent (Zier).

Liquorice-root consists of lignin, starch, wax, resinous oil, colouring matter, albumen, malic acid, earthy phosphates and sulphates, an azotized crystalline principle (agedoïte) which seems identical with the asparagin of althæa-root and asparagus, and a peculiar principle termed Glycion, glycin, glycyrrhin, or glycyrrhizin (Robiquet). The slight acridity of the root is attached to the oleoresin, and its sweetness to the glycion. The oleo-resin is not soluble in water, except with the concurrence of other principles, and even then only with the aid of heat; whence arises the reason for preparing the officinal extract of liquorice with cold water. Glycion is obtained from a concentrated infusion of the root by precipitating it with sulphuric acid,—washing the precipitate, first with water acidulated with the same acid, and then with a very little pure water,—dissolving what remains in alcohol, neutralizing the alcoholic solution with carbonate of potash, and then gently evaporating the filtered fluid to dryness (Berzelius). Glycion so obtained is a yellowish, transparent, brittle, uncrystallizable substance of a most intense sweet taste. Heat causes it to swell up, and at a higher temperature it burns with a clear white flame. It is soluble in water and in alcohol. It partakes of the properties both of acids and of bases; for it forms sparingly soluble, sweet compounds with the former, and it not only combines with the latter, but will even slowly decompose the carbonates of the earths and fixed alkalis, and disengage their carbonic acid. It appears also to unite with many metallic salts. It differs in many respects from common sugar, but chiefly in not yielding oxalic acid when treated with nitric acid, and in not being susceptible of the vinous fermentation. Its constitution when pure is said to be $C^{18} H^{21} O^7$ (Lade). Trommsdorff found in the root of *Glycyrrhiza echinata* a principle capable of fermenting with yeast, but similar to glycion in all other respects; and he also obtained a little uncrystallizable sugar. Zier got 30 per cent of glycion in a well prepared extract from the root of *G. echinata*, and only 11.6 per cent in the purified extract of common

liquorice; but his specimen of the latter seems to have been of low quality. Berzelius found Glycion in the roots of the *Abrus precatorius*, *Trifolium alpinum*, and *Astragalus Ammodytes*, which have a taste like that of liquorice-root; and it probably exists in other leguminous roots and leaves possessing the same property.

Adulterations.—Liquorice-root is not much subject to adulteration. The inferior qualities however are often substituted for the finer sorts. The latter are known by the thinness and smoothness of the epidermis, the absence of knots, warts, mouldiness, or worm-marks, a high density, and a strong sweet taste without bitterness or much acridity. The root of *G. echinata*, sometimes met with in continental trade under the name of Russian liquorice-root, but unknown in the English market, is inferior in sweetness to the common root, of a paler yellow colour, and less compact, so that it floats for some time in water. Fée says this species is sometimes cultivated instead of the common liquorice-plant because it withstands cold better.

Liquorice is often of inferior quality, from being empyreumatised, or from the addition of cherry-gum, gum-arabic, starch, gelatin, or the inspissated juice of plums, or from the accidental admixture of earth, copper, or its oxide. The most esteemed is the Italian kind made by Solazzi and stamped with the manufacturer's name. What is sold in little sticks of the thickness of a goose-quill under the name of Refined liquorice is a mixture of good liquorice with gum or gelatin. Most pharmacologists indicate copper, derived from the pans in which it is prepared, among its adulterations. This dangerous impurity is rare in the liquorice met with in Britain. It may be detected by immersing a polished iron plate in the decoction, or by acting with nitric acid on the residue of incineration, and testing the solution with excess of ammonia, which produces a deep violet colour if copper be present. It should be remembered at the same time that the best liquorice may contain a little copper, because this metal has been discovered in the root in the proportion of about a 50,000th part (Zier).

Actions and Uses.—Liquorice-root and its extract are demulcent in their action, and among the most effectual of this class of remedies in allaying cough from irritation of the fauces and glottis, and in mitigating the pain which accompanies diarrhœa and most irritations in the urinary organs. Unlike common sugar, they allay thirst. They are also excellent articles for sweetening diet-drinks, or for covering the taste of nauseous drugs, such as aloes. Liquorice-root powder is often employed for covering pills; and few substances equal this powder for imparting due solidity to pills, or its extract for giving viscidity to them. For the latter purpose however the extract, though much used in extempore prescriptions, is inferior to conserve of roses and treacle, because pills made with it soon become hard. This preparation likewise constitutes the ex-

cipient of many lozenges or troches, and is the chief ingredient of the Edinburgh *Trochiscus glycyrrhizæ*. Besides its own proper preparations, there are nine officinal compounds into which liquorice-root enters, namely, the *Trochiscus opii*, E. *Trochiscus lactucarii*, E. *Decoctum aloes compositum*. *Decoctum guaiaci*, E. D. *Decoctum sarzæ compositum*. *Decoctum hordei compositum*, D. L. or *Mistura hordei*, E. *Decoctum mezerei*, E. D. *Infusum lini*. *Tinctura aloes*.

GOSSYPIUM, *E. Hairs attached to the seeds of Gossypium herbaceum, L. W. DC. Spr. and other species of the genus. Raw cotton.*

For. Names.—*Fren.* Coton.—*Ital.* Cotone; Bambagia —*Span.* Algodon.—*Port.* Algodaõ.—*Ger.* Baumwolle.—*Dut.* Katoen.—*Swed.* Bomull —*Dan.* Bomuld. *Russ.* Chloptschataia bumaga.—*Arab.* Kootn.—*Pers.* Poombeh.—*Hind.* Rooe.—*Beng.* Kapase; Tula.

Figures of Gossypium herbaceum, and G. arboreum in Royle's Him. Bot. xxiii. 1, 2.

The most important of the economic uses of Cotton, the making of calico, was probably first discovered at a remote period in Eastern Asia. Contrary to what was at one time supposed, the ancient Egyptians were not acquainted with it. It was likewise unknown to the Greeks in the time of Herodotus; but Theophrastus mentions it, and so does Pliny at a later period. The utility of raw cotton as a therapeutic agent is of recent discovery.

Natural History.—Cotton is produced by various species of the genus *Gossypium*; which belongs to the Linnæan class and order *Monadelphia Polyandria*, and to the Natural family *Malvaceæ* of Decandolle and of Lindley. The botanical history of the genus has been rendered complex and uncertain by the effects of long cultivation in multiplying varieties. Professor Royle describes eight species and admits others, as furnishing in various countries the cotton of commerce. Decandolle has acknowledged eighteen, others twenty-nine; and Mr Bennet mentions that he was acquainted with one hundred varieties. Swartz on the other hand imagines they may be all referred to one original species. The *Gossypium herbaceum* is the species to which the greater part of the superior qualities of cotton may be plausibly referred. It is a biennial or triennial plant, with a stem from two to six feet in height. It bears beautiful malvaceous flowers of different colours, and capsules varying in size from that of a hazel-nut to that of a walnut. The capsules contain about five kidney-shaped seeds, covered with a grayish down, and having attached to them numerous long, delicate, silky filaments through means of which they may be carried to a distance by the wind, and so disseminated. These filaments or hairs constitute the Raw cotton or Cotton-wool of commerce. The *G. herbaceum* and other species are cultivated in immense quantity for their cotton in many regions of Asia,

Africa, and America, and even in some parts of the south of Europe. They have a wide range of distribution as to altitude, being found from near the level of the sea to 4000 feet on the Himalayas in Northern India (Royle), and to 9000 feet in tropical America (Humboldt).

Chemical History.—The Cotton-plant, like other species of the natural family of vegetables to which it belongs, presents throughout most of its organization a great abundance of mucilage; on account of which it may be used, as indeed it actually is in some countries, for supplying demulcent preparations. Its seeds too yield in considerable quantity a fine fixed oil, which belongs to the drying sort. But its only officinal product in the European Materia Medica is the filamentous tufts of the seeds, called Raw cotton. This substance is snow-white or pale-yellow. The filaments are flattened tubes twisted upon themselves. It is highly combustible, insoluble in water, alcohol, ether, or the oils, in weak alkalies or in the vegetable acids, and convertible into malic acid by nitric acid with the aid of heat, and without heat into the familiar substance called gun-cotton. It has a strong affinity for alumina, oxide of tin, and tannin; and hence these substances are used as mordants in the art of dyeing calico. It has not been analyzed, but is probably a variety of lignin. Its most convenient form for medical use is the wadding of milliners; which consists of thick, loose, soft sheets, stiffened slightly on both sides with starch.

Actions and Uses.—The chief use made of raw cotton is in the treatment of burns. It has been long a popular remedy for this purpose in Britain, and has been for some time in current use among surgeons in the United States. The first, and still the best account of experiments made with it in this country, was given in 1828 by Dr Anderson of Glasgow. When cotton is applied to the surface of a recent burn, it allays pain, prevents or lessens blistering, diminishes inflammation, limits consecutive local action of every kind, and consequently tends both to keep down constitutional disturbance and to prevent the formation of ugly scars. The cotton ought to be applied in many successive layers; and if wadding be used it must be split into two, and the unstarched surface put next the burn. If vesication has taken place before the cotton is applied, the blisters may be first opened; but this is unnecessary if pressure with a spiral bandage be attainable, for absorption of the fluid speedily ensues. Wherever uniform pressure by such a bandage can be resorted to, it is an important addition. Where the integuments are so deeply injured that ulceration or sloughing must follow, fine linen spread with lard should be put smoothly over the part before applying the cotton. When the discharges from the burn become so profuse as to render it necessary to change the dressings, the innermost layers of cotton should be left undisturbed. Five or six days are commonly sufficient to complete the cure, when the skin has not been disorganiz-

ed.——The mode of action of raw cotton is obscure.—The same treatment may be successfully employed in dressing blisters (Maclagan), in erysipelas, and erythema, and even in spreading cellular inflammation, provided the part affected will admit of moderate and uniform pressure.

GRANATUM, *L.* *The rind of the fruit of Punica Granatum.*

GRANATI RADIX, *E.* *Root-bark of Punica Granatum, L. W. Spr. DC.* *Pomegranate-bark.*

PUNICA GRANATUM, *D.* *External tunic of its berries.* *Bark of the root.* *Flowers.*

DECOCTUM GRANATI, L.

PROCESS, *Lond.* Take of Pomegranate (fruit-rind) two ounces; Distilled water a pint and a-half. Boil down to a pint and strain.

FOR. NAMES. Punica Granatum.—*Fren.* Grenadier.—*Ital.* Granata.—*Span.* Granadas.—*Port.* Romeira.—*Ger.* Granatbaum.—*Swed.* Granattrad.—*Dan.* Granattraec.—*Russ.* Granatnik.—*Arab.* Rana; Roman.—*Pers.* Anar.—*Tam.* Magilam palam.—*Hind.* Anar.

FIGURES of Punica Granatum in Nees von. E. 301.—Hayne, x. 35—Steph. and Ch. i. 57.—Bot. Mag. 1832.

THE Pomegranate-tree has been known from remote antiquity, being mentioned in the books of Moses. The Greek and Roman physicians used the flowers in medical practice under the name of Κυτινοι, Βαλαυστια, Balaustia, or Flores balaustiorum, and the fruit-rind under that of Σιδιον or Malicorium. The more important root-bark, known as an anthelmintic to Dioscorides, and also used as such immemorially in Hindostan, had been long entirely abandoned in Europe, but was introduced again into European medicine in 1807 by Dr Buchanan.

Natural History.—The plant is the *Punica Granatum* of botanists, and belongs to the Linnæan class and order *Icosandria Monogynia*, and to the Natural family *Myrtineæ* of Decandolle or *Myrtaceæ* of Lindley. It seems to grow naturally over a great extent of the warmer parts of Asia and Northern Africa. It is supposed to have been introduced into Italy, and thence throughout the south of Europe, by the Romans during the Carthagenian wars; whence its present botanical designation, and the classical name of its fruit, *Punicum malum.* It is cultivated in almost every warm climate to which civilization has extended. It withstands the winter of Britain, but does not thrive, and seldom flowers in the open air. It is a beautiful shrub, which in favourable situations becomes a small tree about sixteen or eighteen feet in height. It produces in July and August splendid dark-scarlet flowers, which are often doubled. Its fruit resembles an orange in size, form, and colour, but is crowned by the hardened persistent calyx. The rind is leathery. The cavity is divided into numerous irregular cells, which are full of hard seeds imbedded in a reddish, watery, subacid, sweetish,

somewhat astringent pulp. The finest pomegranates grow in Persia and Cabul; and in the latter country, on the river of the same name, a variety without seeds is cultivated (Burnes). The root is large, ligneous, knotty, and hard. The official parts are the flowers, the rind of the fruit, and the bark of the root. The last, though not recognized by the London College, is the article prevalently used in British practice.

Chemical History.—The FLOWERS, now retained by the Dublin College only, have a bitterish astringent taste, without aroma. Their infusion gives a deep bluish-black precipitate with the salts of sesquioxide of iron.

The FRUIT-RIND (*Granatum*, L. *Punicæ Granati Cortex*, D.) is brown externally when dry, yellow within, about a line in thickness, smooth or finely warty, hard and brittle, without odour, but of a very astringent and somewhat bitter taste. The infusion gives an abundant dark bluish-black precipitate with the salts of iron. It consists of 18.8 per cent of tannin, 17.1 of mucilage, 10.8 extractive matter, 30 lignin, a trace of resin, and 29.9 moisture (Davy).

The ROOT-BARK is usually sold in quills or portions of quills from two to six inches long, between half an inch and a whole inch in breadth, and nearly a line in thickness, externally grayish-yellow with green specks, yellow internally, brittle and not stringy. It has a faint peculiar odour. The fresh root has an astringent bitter taste; but when dried the bitterness is nearly lost. It tinges the saliva yellow when chewed. An infusion yields a deep blue precipitate with the salts of iron, a yellowish-white one with solution of isinglass, and a grayish-yellow one with corrosive sublimate; and potash or ammonia colours it purple (Latour de Trie). It has been repeatedly analysed; but the source of its activity as a medicinal agent has not yet been discovered. Wackenroder found 22 per cent of tannin in the dried root, 26 of starch united with gum, tannin, and lime, 45.5 lignin, and 2.5 concrete oil. Mitouart found also wax and a principle like mannite. Latour de Trie thought he obtained a peculiar crystalline principle; which, however, appears to have been nothing else than the mannite of Mitouart. Bonastre says the fresh root contains a little volatile oil. Righini ascribes the properties of the root to an oleo-resin, which he obtained by preparing a dry alcoholic extract from the watery extract, heating this in the vapour-bath with eight parts of water holding in solution a 64th of caustic potash, neutralizing the alkaline solution with sulphuric acid, and washing on a filter with cold water the oleo-resin which separates. The bark of the wild pomegranate is commonly stated to be fitter for medical use than that of the cultivated plant. But according to Pichonnier this is a mistake. Chevallier however even goes so far as to allege that the root of the cultivated pomegranate is quite inert. It is usually

administered in the form of decoction. But Batalliat says a cold infusion obtained by percolation is more energetic.

Adulterations.—Pomegranate root-bark is sometimes adulterated with the root-bark of the box, or with the branch-bark of the barberry. The former is nearly white, bitter, and not astringent, and its infusion is not precipitated by the salts of iron. Barberry bark has a considerable resemblance to the root-bark of the pomegranate; but it is very bitter and not astringent, and an infusion is not affected by the four reagents mentioned above as acting on the infusion of genuine bark,—the salts of iron, solution of isinglass, corrosive sublimate, and potash.

Actions and Uses.—The action of the several officinal parts of the pomegranate is astringent. The flowers were in use in ancient times for arresting mucous discharges and passive hemorrhagies. The fruit-rind was long used for the same purposes, and likewise as a febrifuge in ague, and an anthelmintic in tape-worm. At present these properties, and the parts which have been supposed to possess them, have fallen deservedly into neglect. But the anthelmintic properties of the root-bark have attracted much attention in Europe since they were made known by Dr Buchanan, Mr Breton, and other medical officers in India as a familiar vermifuge remedy in that country. It is chiefly serviceable in tape-worm; in which it seems scarcely ever to fail if properly used. It is less active when dried than when fresh, but, according to my observation, far from being so inert as Mérat is inclined to suppose. It acts with greatest certainty if given when joints of the worm are coming away naturally. It often causes nausea and some vomiting; which however may be owing, less to any intrinsic effect of the remedy, than simply to the agitation into which the worm is thrown. It commonly occasions several stools and sometimes an increased flow of urine (Mérat). The original mode of administering it is to steep two ounces of bark in two pints of water for twelve hours, then to boil the whole down to one pint, and to give a wine-glassful of the strained decoction every two hours till the whole is taken. But according to Batalliat the same quantity of bark exhausted by fifteen ounces of cold water by the method of displacement, yields a more active preparation. Sometimes joints of the worm begin to come away in less than an hour after the last dose; but often the doses must be repeated several successive mornings before they take effect; and it is right to repeat them occasionally for four or five days after joints have ceased to come away. Laxatives should also be administered from time to time.

The doses of other parts and preparations of the pomegranate are as follows: *Granatum*, L. scr. i. ad scr. ii. *Decoctum granati*, L. fl. unc. ii. ad fl. unc. iv.

GUAIACI LIGNUM. *Wood of Guaiacum officinale, L. W. DC. Spr. Lignum-vitæ.*

GUAIACUM, *E.* GUAIACI RESINA, *L. D.* *Resin (obtained by heat from the wood, E.) of Guaiacum officinale, L. W. DC. Spr.* *Guaiac.*

TESTS, *Edin.* Fresh fracture red, slowly passing to green. The tincture slowly strikes a lively blue colour on the inner surface of a thin paring of a raw potato.

DECOCTUM GUAIACI, E. DECOCTUM GUAIACI COMPOSITUM, D.

PROCESS, *Edin. Dub.* Take of
Guaiac-turnings, three ounces;
Sassafras, rasped (cut, D.) one ounce (ten drachms, D.)
Liquorice-root bruised, an ounce (two ounces and a half, D.)
(Raisins, two ounces, E.)
Water, eight pints (ten pints, old wine measure, D.)
Boil the guaiac (and raisins, E.) with the water down to five pints (one-half, D.) adding the liquorice and sassafras towards the close. Strain the decoction.

AQUA CALCIS COMPOSITA, D.

PROCESS, *Dub.* Take of
Guaiac-turnings, half a pound;
Liquorice-root,' cut and bruised, an ounce;
Sassafras bark, bruised, half an ounce;
Coriander-seeds, three drachms;
Lime-water, six (old wine) pints.
Macerate without heat for two days in a closed vessel, shaking occasionally; and then strain.

MISTURA GUAIACI, E. L.

PROCESS, *Edin. Lond.* Take of
Guaiac-resin, three drachms;
Sugar, half an ounce;
Mucilage, half a fluidounce;
Cinnamon-water, nineteen fluidounces.
Triturate the guaiac with the mucilage, and then add gradually the cinnamon-water, with constant trituration.

TINCTURA GUAIACI, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Guaiac-resin, in (coarse, E.) powder, seven (four, D.) ounces;
Rectified spirit, two pints (old wine measure, D.)
Digest for seven (fourteen, L.) days, and then filter.

TINCTURA GUAIACI AMMONIATA, E. D. TINCTURA GUAIACI COMPOSITA, L.

PROCESS, *Edin. Lond. Dub.* Take of
Guaiac-resin, in (coarse, E.) powder, seven (four, D.) ounces;
Spirit of ammonia (aromatic, L. D.) two pints (a pound and a half, D.)
Digest for 7 (14, L.) days, and filter.

FOR. NAMES. *Fren.* Gaïac.—*Ital.* Guaiaco; Legno Santo.—*Span.* Guayaco; Palo santo.—*Port.* Guaiaco.—*Ger.* Pockenholz; Franzosenholz.—*Dut.* Pokhout.—*Swed.* Pockenholz.—*Dan.* Pockenholt; Guajak.—*Russ.* Bakaut.

FIGURES of Guaiacum officinale in Nees von E. 380.—Hayne, xii. 28.—Steph. and Ch. ii. 90.—Roque, 147.

GUAIAC-WOOD, and probably also its resin, were introduced into European medicine from the West Indies by the Spaniards about the year 1508, not long after the discovery of the New World.

Natural History.—They are produced by the *Guaiacum officinale*, a plant belonging to the Linnæan class and order *Decandria Monogynia*, and to the division *Zygophylleæ* of Decandolle's Natural family *Rutaceæ*, or to the *Zygophyllaceæ* of Lindley. It is a beautiful tree of considerable height, growing naturally on the West Indian Islands, but especially in Jamaica, St Domingo, and St Thomas. It produces bijugate leaves with obovate leaflets, and elegant, pale-blue, quinque-petalous flowers. Its officinal parts

are the wood and resin; but the bark was also once officinal and is probably its most active part.

Chemical History.—The Bark is heavy, hard, flat, a few lines thick, externally fissured, and of a greenish-black colour, speckled with grayish and yellowish spots, internally grayish-yellow, without odour, but of a peculiar acrid taste affecting chiefly the back of the palate and throat. According to the analysis of Trommsdorff the bark contains some common resin, but less of the peculiar resin of guaiac than the wood, and on the contrary much more of the acrid extract, upon which the activity of the preparations of this plant has, not without reason, been conceived by some to depend.

The Wood, commonly called Lignum-vitæ, is largely imported into this country from the West Indies, and chiefly from St Domingo for making block-sheaves, wooden-pestles, and many other objects, for which it is peculiarly fitted by its extraordinary hardness and toughness. It is imported in billets, sometimes about a foot in diameter, and generally without the bark. It is remarkably close in texture, hard, tough, and 1333 in density, so that it sinks quickly in water. It consists of a broad grayish-yellow alburnum, and a dark, dirty greyish-green or greenish-black duramen, the latter of which is the denser and heavier of the two. The Guaiac-wood of the druggist consists of turnings from the workshop of the turner, and is a uniform mixture of the alburnum and duramen. It has an acrid aromatic taste, attended with a singular pricking in the throat, which is excited most strongly by the alburnum. When rasped, it exhales a peculiar aromatic odour and excites sneezing. It burns with a strong clear flame. Nitric acid turns it greenish. Boiling water and alcohol alike take up its active parts,—the latter dissolving 21 per cent, the former 10 according to Neumann, and 17 according to Geiger. Water is a common officinal solvent, and is used for preparing both the *Decoctum guaiaci compositum* of the Edinburgh and Dublin Pharmacopœias, in which the virtues of guaiac are united with those of sassafras,—and likewise the Dublin *Aqua calcis composita,* a preparation which cannot differ materially from the common decoction, as its lime-water must be in a great measure neutralized during the process. The simple decoction has an acrid taste, like the wood itself. It has a yellowish colour, which is not altered by nitric acid, scarcely by the salts of iron, and not at all by tartar-emetic or solutions of tannin. Guaiac-wood has not yet been carefully analyzed. But it contains besides a trace of benzoïc acid (Jahn), an acrid principle, and the peculiar resin of guaiac; the former of which abounds most in the alburnum, the latter in the central wood. The central wood has been commonly preferred in medicine, and some pharmacologists even direct the alburnum to be removed, because they consider the resin its only active principle. This however is probably a mistake, and the more acrid alburnum ought perhaps to be preferred.

Guaiac-wood, as found in the shops of British druggists, is scarcely subject to adulteration. It is known to be genuine by its sinking in water, by its chips being a mixture of yellowish and greenish shreds, and by its peculiar taste. The wood of a Mexican species, the *Guaiacum sanctum*, is sometimes met with in continental commerce. It is yellowish and semitransparent, like horn, and is probably as fit for medical use as the wood of officinal guaiac.

Resin of Guaiac, Gum-guaiac, or simply Guaiac, is obtained from the wood of the tree. It is said to be sometimes a natural product formed by exudation spontaneously or after incisions. Most of the guaiac of the shops is got artificially with the aid of heat; but that which comes from St Domingo now contains a few tears which are probably obtained by exudation from incisions. It may be separated by boiling the chips and raspings of the wood in a strong solution of salt. The usual process however consists in heating billets several feet long which have been previously perforated from end to end, and collecting the resin as it slowly flows out from the depending extremity. Guaiac is imported in irregular lumps of various sizes. It often contains chips of wood. Its surface is brownish-red or brownish-yellow when recent, but becomes greenish under exposure to light. Its density is 1023. It is brittle, presents a splintery vitreous fracture, and possesses some translucency. Its powder, at first grayish, gradually acquires a greenish tint. It emits a somewhat balsamic odour while triturated, and has a faintly-bitter sweetish taste, followed by a pricking in the back of the throat, which is very strong and unpleasant if it be tasted in powder. The heat of the hand does not render it adhesive; a strong heat fuses it and strengthens its odour; and a decomposing heat drives off balsamic, irritating fumes. Water acts feebly on it, and acquires a sweetish taste. With the aid of mucilage and sugar an emulsion may be formed, as exemplified by the *Mistura guaiaci.* Alcohol and rectified spirit dissolve it readily, and form a dark reddish-brown fluid, from which the guaiac is precipitated by water, by sulphuric or muriatic acid, but not by acetic acid or the alkalis. Rectified spirit is the officinal solvent for the *Tinctura guaiaci.* Ether acts on it less energetically, fixed and volatile oils scarcely at all. Solutions of the fixed alkalis dissolve it freely. So does ammoniated alcohol, which is the officinal solvent in the best of its medicinal preparations, the *Tinctura guaiaci ammoniata*, or *Tinctura guaiaci composita.* Sulphuric acid forms with it a deep-red solution; and nitric acid converts it into oxalic acid and an extractive matter, without producing any artificial tannin. The powder or tincture of guaiac, when mixed with moistened flour, slowly renders it blue under exposure to the air. The same blue colour is produced, but of a livelier tint, when the tincture is poured upon a transverse incision of various roots. This effect is well observed with the potato, in which it is chiefly confined

to a thin stratum under the integument. Some time is required for the full effect to be produced; but the access of air seems not to be necessary. A similar effect is produced on an infusion of bruised oats, barley, rye, colchicum-seeds, althæa-root, onions, also on mucilage of gum-arabic made with cold water, and on cow's milk. The colour is not produced, if the substance to which the tincture is added be previously heated to 212° or dried spontaneously, or if the tincture be long kept.

Buchner found guaiac to consist of an acrid extractive matter, not essential to it, but derived from the wood or bark, and of resin, which when pure is bland, and presents all the chemical characters mentioned above as distinguishing crude guaiac. This resin has been since ascertained by Jahn to consist of three resins, one soluble in ether or ammonia, forming 18.7 per cent of the crude drug, another soluble in ether, but scarcely in ammonia, and amounting to 58.3 per cent, and another, which constitutes 11.3 per cent of the drug, and is soluble in ammonia but not in ether. The remaining 11.7 per cent consists of bark, wood, impurities, and a trace of benzoic acid. It has been latterly conceived by some, that the adventitious acrid extract of Buchner is the only active ingredient of guaiac; but this opinion requires farther investigation.

Adulterations.—Guaiac is a good deal subject to be adulterated on the continent. The most frequent fraud is said to be the substitution of a counterfeit article made of colophony coloured green artificially. Fragments of the spurious article are easily distinguished by the characters given in the Edinburgh Pharmacopœia. The fresh fracture is green, not red; and the tincture does not render the fresh-cut surface of a potato blue, like tincture of guaiac. If powder of guaiac contains colophony, a turpentine odour is exhaled when it is heated; and if the tincture be first decomposed by water and then made clear again by solution of potash, an excess of this reagent restores the turbidity, which does not occur with tincture of pure guaiac (Schaub and Bucholz).

Actions and Uses.—Guaiac-wood and guaiac-resin are in their action stimulant, diaphoretic, diuretic, and cathartic. Soon after being swallowed, they cause in the stomach a sense of warmth, which is followed by slight increase of the pulse and temperature, and afterwards by diaphoresis and sweating if the body be kept warm, or by a flow of urine if it be kept cool. Large doses produce a gentle laxative effect; and if too large, they are said to excite anxiety, drowsiness, and slight salivation.—These physiological properties form the basis of the most important of their uses in the present day, their application to the treatment of chronic rheumatism. They have been employed also, though with more doubtful advantage, in gout. In scrofulous complaints diet-drinks, containing guaiac-wood, among other stimulating woods and roots, were in much repute about the close of last century. In chronic cutaneous diseases both the wood and the resin are sometimes of obvious ad-

vantage, probably by tending to restore capillary action. At one time the most important of the therapeutic applications of guaiac-wood was in the treatment of syphilitic diseases; in which it was imagined by some to possess specific virtues little inferior to those of mercury. Although its utility as an antivenereal was much overrated by many, it is on the other hand by no means the inert agent which some strenuous mercurialists will have it to be. As a diaphoretic and alterative it is probably serviceable, along with a restricted diet and careful regimen, even in the primary form of the disease; and it constitutes a material part of almost all the compound decoctions or diet-drinks, which, for two centuries past down to the present day, have been successively in vogue for the treatment of secondary syphilis, especially where mercury has been used to excess, or where the constitution is enfeebled by a tendency to struma. The best preparations for long-continued use as an alterative diaphoretic are the decoctions of the wood, which are given without addition. For producing a stronger diaphoretic and sudorific effect the most esteemed preparations are the mixture, tincture, and ammoniated tincture, the last of which is probably the most powerful of all. The tinctures are given in from two to four ounces of water; and as both of them are decomposed by this menstruum, the mixture must not be allowed to stand long before being taken. Milk is a more convenient vehicle than water for those who can take it without inconvenience; for in this way an excellent emulsion may be at once prepared extemporaneously with either of the tinctures. The preparations of guaiac must not be continued if they produce sickness, defective appetite, and irregularity of the bowels,—which effects occasionally ensue when they have been long used without intermission.

The doses of the officinal preparations are: *Guaiacum*, E.; *Guaiaci resina*, D. L. gr. x. ad scr. i. *Guaiaci decoctum*, E.; *Guaiaci decoctum compositum*, D. fl. unc. ii. ad fl. unc. iv. *Aqua calcis composita*, D. fl. unc. ii. ad fl. unc. iv. *Tinctura guaiaci*, fl. dr. i. ad fl. dr. ii. *Tinctura guaiaci ammoniata*, E. D.; *Tinctura guaiaci composita*, L. fl. dr. i. ad fl. dr. ii. Guaiac-wood also enters into the composition of the *Decoctum sarzæ compositum* (see *Sarza*); and the resin forms part of the *Pulvis aloës compositus*, L. D.; and of the *Pilula calomelanos composita*, E. D.; or *Pilula hydrargyri chloridi composita*, L. (see *Hydrargyri chloridum*).

GUMMI ACACIAE, *E.* GUMMI ARABICUM, *D.* ACACIA, *L.* *Gum of various species of Acacia, W. DC. Spr. Gum-arabic, (Edin.) Gum of Acacia vera, W. DC. (Lond.) Gum of Acacia vera and Acacia arabica (Dub.)*

MUCILAGO, E. MISTURA ACACIAE, L. MUCILAGO GUMMI ARABICI, D.

PROCESS, *Edin.* Take of
Gum-arabic, nine ounces;
Cold-water, one pint.
Mix them; let the gum dissolve without applying heat, but with occasional stirring; strain through linen or calico.

PROCESS, *Lond.* Take of
Gum-arabic, in powder, ten ounces;

Boiling-water, a pint.
Triturate the gum with the water, added gradually, and dissolve it.
PROCESS, *Dub.* Take of
Gum-arabic, in coarse powder, 4 ounces;
Boiling-water, four ounces by measure.
Digest, with frequent stirring, till the gum be dissolved; and then strain through linen.

MISTURA ACACIAE, E. EMULSIO ARABICA, D.

PROCESS, *Edin.* Take of
Mucilage, three fluidounces;
Sweet almonds, ten drachms;
Pure sugar, five drachms;
Water, two pints.
Steep the almonds in hot water and peel them; beat them to a smooth pulp in an earthen-ware or marble mortar, first with the sugar, and then with the mucilage: add the water gradually, stirring constantly: strain through linen or calico.

PROCESS, *Dub.* Take of
Gum-arabic, in powder, two drachms.
Sweet almonds, blanched, and
Pure sugar, of each half an ounce;
Water, a pound by measure.
Dissolve the gum in the water heated; when the mucilage is cool, add gradually the almonds previously bruised with the sugar; triturate till the liquid resemble milk; and then strain.

TROCHISCI ACACIAE, E.

PROCESS, *Edin.* Take of
Gum-arabic, four ounces;
Starch, an ounce;
Pure sugar, a pound.
Mix and pulverise them; and make them into a proper mass with rose-water for forming lozenges.

FOR. NAMES.—*Fren.* Gomme arabique.—*Ital.* Gomma arabica.—*Span.* Goma arabiga.—*Port.* Gomma arabia.—*Ger.* Arabisches gummi.—*Dut.* Arabische-gom.—*Swed.* Gummi arabicum.—*Dan.* Arabisk gummi.—*Russ.* Araviskaia kamed.—*Arab.* Sumagh arebee.—*Beng.* Kavit ka goud.

FIGURES of Acacia tortilis in Hayne, x. 31.—Nees von E. 335, and as Mimosa eburnea in Rox. Cor. Pl. ii. 199. Acacia Seyal in Hayne, x. 30.—Nees von E. 336.—Delile Fl Aeg. 52, 2. Acacia Ehrenbergii in Hayne, x. 29. Nees von E. 334. Acacia vera in Hayne, x. 34.—Nees von E. Suppl. 80. Acacia arabica in Hayne, x. 32.—Nees von E. 333,—and as Mimosa arabica in Rox. Cor. Pl. ii. 149. Acacia gummifera in Hayne, x. 28. Acacia Karroo, in Hayne, x. 33. Acacia Verek in Fl. Senegamb, 56.

GUM-ARABIC has been known from remote antiquity. One or other of its Egyptian varieties was probably the Κομμι εκ της ακακιας of Dioscorides.

Natural History.—Gum, in the form of mucilage, is one of the most widely diffused of vegetable principles. There are few plants indeed, whose fluids do not contain more or less of it. A great number also exude naturally a mucilaginous juice, which, after the evaporation of its water, concretes in the form of adhering tears. This is gum. As obtained from different plants, it varies much in nature and properties, but especially in taste and solubility. The most esteemed varieties are quite bland, faintly sweet, entirely soluble, and strongly adhesive. None of them unite all these properties in so eminent a degree as the gums produced by certain species of Acacia, and known by the generic name Gum-arabic, from the country whence they have long been partly obtained.

The genus *Acacia*, which belongs to the Linnæan class and order *Monadelphia Polyandria*, and to Decandolle's Natural family *Leguminosæ*, or *Fabaceæ* of Lindley, is composed of very numerous species inhabiting the hotter climates of the globe, and abounding particularly throughout all parts of Africa. They bear strong and often long thorns, generally delicate tufts of capitate flowers,

and pinnate or bipinnate leaves with minute crowded leaflets. There are few of them which do not yield gum, and in general it is of fine quality. Owing to the close resemblance subsisting between many of the species, and the similarity of their gummy exudations, the botanical history of the present subject is complex and in some measure obscure. There is little doubt however that gum-arabic is all produced by plants of the genus Acacia. It is equally certain that the finest quality of it may be produced by several species, and that there is no ground for the exclusive reference of it by the London College to a single plant,—a reference which is opposed to the observations of the traveller Ehrenberg, the botanical labours of Nees von Esenbeck, as well as Hayne, and the opinion of almost every pharmacologist of note in Europe. It was at one time imagined that the different qualities of gum-arabic might be produced each by a different species of plant. But Ehrenberg, who saw the gum collected in Upper Egypt and Nubia during his travels in these countries, observed that different sorts are produced upon the same tree, and similar sorts on different species; whence it seems to follow, that the several qualities must be collected indiscriminately and sorted afterwards. From the personal observations of this traveller and the subsequent examination of his specimens both by Hayne and Nees von Esenbeck, it would appear that the best qualities of gum-arabic are derived, 1. from *Acacia Ehrenbergii* (Nees von E.) or *Ehrenbergiana* (Hayne), a shrub about six or eight feet high, inhabiting Dongola in Nubia; 2. from *Acacia tortilis* (Hayne—Nees von E.—*Mimosa tortilis*, Forskal), a small tree about twenty feet in height, which grows in Dongola, at Sienna in Upper Egypt, at Haes in Arabia Felix, and at the foot of Mount Sinai; and 3. from *Acacia Seyal* (Delile—Hayne—Nees von E.) a magnificent tree sixty or eighty feet in height, indigenous in Nubia, Arabia, Upper Egypt, and Senegambia.

But gum of various qualities is also produced by many other species of Acacia besides these. It was till not long ago collected in Egypt, 4. from *Acacia arabica* (Dec.—Willd.—Hayne—Nees von E.), a tree between thirty and forty feet high, inhabiting Upper and Lower Egypt, Nubia, Arabia, Senegambia, and the East Indies; and likewise, 5. from *Acacia vera* (Hayne—Nees von E. —in part *A. vera*, Dec.— Willd.), which grows abundantly in the belt of Africa extending from Senegambia to Egypt. Hence at one time these two trees belonged, as the Dublin Pharmacopœia indicates, to the true gum-arabic Acacias. But Ehrenberg ascertained that gum is no longer gathered in Egypt from either of them, as the natives can now turn their labour to better account in agricultural operations. As to *A. arabica*, Guillemin and Perottet mention in their Flora of Senegambia, that it produces there a great abundance of reddish, bitter, gum, which is not collected for exportation; and though Roxburgh states, that gum exuded by this species in the East Indies is used by the natives, " and might

be collected in great quantity," there is no certainty that it constitutes any of what is brought from the East Indies to Europe. It is believed that *A. vera* supplies part of the variety of gum called Gum-Senegal. 6. *Acacia gummifera* (Willd.—Hayne), was ascertained by Broussonet to yield a gum in use at Mogadore on the Morocco coast, where the plant is abundant; and it is thought by recent pharmacologists to produce the commercial variety called Barbary Gum (Pereira—Guibourt). 7. *Acacia Adansonii* (Flore de Senegambia), a native of Senegambia, very like *A. arabica*, and growing to the height of from forty to sixty feet, furnishes, according to Guillemin and Perottet, a part of the inferior, reddish, and somewhat astringent variety of Gum-Senegal. But according to the same authorities the principal part of the paler and finer sort of Gum-Senegal is obtained, 8. from *Acacia Verek* (Fl. Seneg.), a crooked tree, between fifteen and twenty feet high, which inhabits the dry sands of Senegambia from Senegal to Cape Blanco, and abounds particularly in the forest of Sahel about sixty miles inland from Portendic on the confines of the desert of Sahara. 9. *Acacia albida* (Fl. Seneg.—*A. Senegal*, Dec.—Willd.), a straight tree about thirty or forty feet high, which inhabits soils periodically inundated by rivers and nearer the coast, is another species that produces the inferior reddish Gum-Senegal. 10. *Acacia Karroo* (Hayne), the Thorn-bush of the Cape, often confounded with *A. vera*, abounds, according to Barrow as well as Lichtenstein, in the Karroo territories of Southern Africa, whence its gum is introduced into trade; but this variety of gum is of low quality in consequence of its being slightly acrid. Farther the *A. decurrens* (Willd.) of New Holland yields at Port Jackson an exudation like Gum-Senegal; a superior sort of gum is produced by an undescribed species of Acacia, which was seen abundantly by Paterson, and more recently by Sir James Alexander, in the Namaqua and Boschmen territories on the west coast of Southern Africa; and various other species of the same genus have been obscurely indicated as gum-bearing plants by travellers in other parts of the globe.

Gum is produced by the Acacias, in the form of a thick and somewhat frothy juice, soon after the rainy season has softened their bark, and rendered it apt to split during the hot weather that succeeds. The juice speedily concretes in the sun into tears. It is secreted in greatest abundance by old stunted trees and in dry hot seasons. As it is comparatively little seen on thriving plants, it is thought by some to be the result of disease.

A great variety of gums approaching closely in nature to gum-arabic are now currently met with in the English and Continental drug-markets. These are true Gum-Arabic, Gum-Senegal, Barbary Gum, and East India Gum. It may be useful to take some notice here of them all: but true Gum-arabic is the only kind recognized by the British Pharmacopœias.

Description and Natural History.—Gum-Arabic (Turkey-gum)

is so named, because it was long supposed to come from Arabia. Its principal source at present however is considered to be Nubia and Upper Egypt. The fine qualities of it, to which the term Gum-arabic is restricted by many, are imported chiefly from the Mediterranean ports of Africa or the Levant. An inferior mixed sort, distinguished generally as East-India gum, comes from Bombay; whither it is conveyed in the first instance from the Red Sea. Gum-arabic is the finest of the true gums, and is assumed in chemistry as the type of this tribe of substances. After importation it is usually separated into three qualities, called First, Second, and Third Gum-arabic. The *First* quality, called also Picked Gum, the Gomme Turique of the French, is in tears or fragments of tears, seldom larger than a hazel-nut,—colourless or very pale yellowish-white,—much fissured, so as to be almost opaque in mass and as it were vesicular or like concrete froth, but transparent in small fragments,—hard, yet brittle,—of a shining, conchoidal, vitreous fracture,—without odour,—and of a mucilaginous sweetish taste. The *Second* and *Third* sorts, the Gomme Gedda of the French, differ from Picked gum in presenting many tears of much larger size, occasionally weighing one or two ounces or upwards, often of a yellowish-red colour, less fissured, and sometimes compact; they form a more turbid solution with water, and in dissolving part with fragments of bark and other impurities; and their taste is less purely mucilaginous, sometimes slightly acid, at other times faintly bitter or astringent. Many pieces seem scarcely to differ from gum-senegal. The Second and Third sorts differ from one another merely in the degree of these deviations from the characters of picked gum.

The density of gum-arabic is variously stated from 1335 (Guerin) to 1525 (Herberger). It is permanent in the air. Exposure to sunshine bleaches its coloured varieties. It is reduced to powder with some difficulty, is apt to heat if the process be carried on too continuously or forcibly, and then becomes somewhat acid. An iron mortar must not be used for pulverizing it, otherwise the powder, which is naturally pale grayish-white, becomes considerably discoloured. It is not fusible. A heat of 260° F. with the aid of a vacuum, drives off 17.6 per cent of moisture. It is uncrystallizable. The fine qualities of it are entirely soluble in their own weight of water, cold or warm, and form a thick viscid solution, called Mucilage. The Pharmacopœias have all a formula for this preparation, the *Mucilago acaciæ*, E. *Mucilago gummi arabici*, D. or *Mistura acaciæ*, L. The Colleges of London and Dublin direct the solution to be made with boiling water; but mucilage made in this way becomes soon acid. It is best made by tying gum-arabic in a linen bag, and immersing the bag in the due proportion of cold water. A uniform and clear mucilage is thus prepared, which keeps long without becoming sour or mouldy, if not diluted.

Gum-arabic is insoluble in alcohol, but yields to that fluid a little wax and chlorophyll with various salts, which are chiefly calcareous. It consists essentially of 17.6 per cent of water, 3.0 of ashes composed principally of carbonates of potash and lime, and 79.6 of the pure gummy principle called Arabin (Guerin). This principle presents the leading characters of crude gum-arabic. It is transparent, colourless, friable, and in dry air permanent; it becomes slowly acid in a moist atmosphere, acquires ductility between 300° and 400° F., dissolves readily in water, but is wholly insoluble in alcohol. When boiled with sulphuric acid, an unfermentable variety of sugar is formed, like the principle mannite; and when boiled with nitric acid, mucic and oxalic acids are produced. Its mucilage becomes a brown jelly when treated with solution of sesquichloride of iron;—it forms with solution of borax a very firm colourless jelly, which is liquefied by pounded sugar;—and it yields, even when much diluted, a white flaky precipitate with solution of silicate of potash, and likewise with subacetate of lead. Its elementary constitution has been somewhat variously stated by Berzelius, by Gay-Lussac, and by Guerin; but their conjunct researches lead to the conclusion, that it consists of 42.11 per cent of carbon, 51.46 oxygen, and 6.43 hydrogen, that is 12 equivalents of the first, 11 of the second, and 11 of the third (Thomson), and consequently that it is identical in composition with sugar ($C^{12}H^{11}O^{11}$).

Adulterations.—Gum-arabic is subject to be adulterated with the inferior gums, the picked quality with the two other sorts of true gum-arabic, and all of these with gum-senegal, Barbary gum, East India gum, cherry-tree gum, and other varieties of the gummy principle. It is easily known however, especially the picked sort, which ought alone to be used in medicine, by the characters given above, and more especially by its freedom from colour, its frothy appearance, its brittleness, and its perfect and easy solubility. A few remarks may be here added on the other kinds of gum which resemble it most, and are sometimes substituted for it.

Gum-senegal,—the product chiefly of *Acacia Verek* but partly of *A. Adansonii*, *albida*, and *vera*, as well as probably other species,—is collected in the forests of Senegambia near the Senegal in the months of December and January, and exported in great quantity to Europe chiefly from Portendic. The best sort, obtained from *A. Verek* (Fl. de Seneg.) is in tears or fragments of tears, often hollow, varying in size from that of a small hazelnut to that of an ostrich's egg, roundish or vermicular, dry, hard, not so brittle as gum-arabic, wrinkled on the surface, compact and uniform in texture, vitreous in fracture, whitish or very pale wine-yellow in colour, and of a faintly-sweetish mucilaginous taste. It is soluble in four or five parts of temperate water, and forms a strong mucilage, which is somewhat acidulous, and presents nearly the same reactions with chemical tests as mucilage of gum-arabic. An in-

ferior sort, composed chiefly of broken, angular, glassy, pale, reddish-yellow fragments, is produced higher up the river, probably from *A. vera* and *Adansonii*, and is distinguished in French commerce by the name of Galam gum. Gum-Senegal is most extensively used in the arts for the same purposes as gum-arabic, which it closely resembles in all its properties. Guillemin and Perottet even consider it identical; which however is a mistake. Its density is 1436. When of good quality it is entirely soluble in water, with the exception at least of a few membranous-like flakes and particles of incidental impurities; but it requires four times as much water for solution as gum-arabic. It consists of 16.1 per cent of water, 2.8 ashes, and 81.1 arabin (Guerin). As imported, it is often mixed with inferior gums, some of which are only in part soluble; and tears of the resinous substance bdellium are not unfrequent.

Barbary-gum, which is brought from Mogadore on the west coast of Morocco, is supposed to be the produce of a tree called by the Arabs Atalleh; which seems to be the *Acacia gummifera* of Willdenow and Hayne. It is described as forming small irregular longish tears, often containing impurities, of a yellowish tint inclining to green or brown, very tenacious between the teeth, and not entirely soluble in water. The specimens I have received from wholesale dealers in London as Barbary-gum seem to show that this variety is a very mixed substance. They consist of tears of various sizes, many of them as big as walnuts, but most of them much broken. Some are fissured and opaque, pale-wine-yellow, brittle, and entirely soluble, and therefore resemble the second qualities of gum-arabic. Others are deep-wine-yellow, or pale-garnet-red, and also entirely soluble. Others again, and these the most numerous, present the external appearance of gum-senegal, are glassy in fracture, less frangible than any other gum I have examined, and only in part soluble in water, the remaining portion swelling up without dissolving. These three sorts evidently cannot be all produced by the same tree. The last of them is an inferior gum, approaching in properties less to gum-arabic than to tragacanth and bassora, and probably composed like them of arabin and bassorin (see *Tragacantha*).

East India gum is a term which has two significations. In commerce it is applied incorrectly to what appears in a great measure coarse gum-arabic, imported from the shores of the Red Sea by way of Bombay; but some restrict the name more appropriately to gum of East Indian origin. The former is met with largely in the English market, of various qualities, but always inferior. The latter is scarcely commercial in Europe. I have received from friends in the East Indies two very distinct species of gum produced in the country itself. One, (Babul ka gond, *Beng.*) from the Apothecary-General's stores at Calcutta, and represented to me to be obtained, as its Bengalee name would indicate, from the *Acacia Arabica* or Babul tree, is in large roundish lumps, sometimes weigh-

ing one pound, deep reddish-brown in colour, transparent in small fragments, compact, brittle, glassy in fracture, of an unpleasant woody taste, and entirely soluble in water with the exception of fragments of leaves, wood, and the like, which it contains in abundance. The other (Vullam pisin, *Tam.*) from *Feronia elephantum*, is in irregular, generally longish tears, smooth on the surface, transparent or very translucent, of a pale amber colour, hard, compact, glassy in lustre, of a pure mucilaginous taste, and entirely, though not very easily, soluble in water. I believe both of these gums are much used in various parts of India. I have not observed them in any of the gums of European trade, that have come under my observation; but it is possible that the former is the red or brown sort mentioned by Dr Pereira as occurring in chests of what is imported into London under the name of East-India-gum.

To these might be added Cape-gum, an inferior kind lately imported from the Cape of Good Hope in small but increasing quantities (Pereira), and possibly derived from the *Acacia Karroo*.—— I have repeatedly received from Australia, under the name of New-Holland-gum, a species which considerably resembles the East-India-gum of commerce. It is probably the produce of *Acacia decurrens*. It is not commercial, and though entirely soluble in water, will probably never become an object of European trade, because its mucilage is feebly adhesive.——Essentially different from all of these is the substance called British-gum or Starch-gum, prepared by gently roasting starch till it becomes yellowish, then dissolving the soluble part in cold water, and evaporating the solution to dryness. This is like the inferior pale-yellow gum-arabic. Its solution is easily distinguished by not being gelatinized by sesquichloride of iron, or precipitated by silicate of potash (Geiger).

Actions and Uses.—Gum-arabic is in its action nutritive and demulcent. Arabin, its chief component part, is one of the most nutritive of vegetable principles, and enters into the composition of the greater part of articles of food from the vegetable kingdom. In the form of gum-arabic it is said to be during the gum harvest the chief sustenance of the Africans who collect it for commerce, and likewise to be much sought after by the monkey-tribe. By some physicians it is used as a nutrient during convalescence from acute diseases. It is one of the most familiar and most useful of demulcents, for lubricating the mucous membranes when their secretion is defective or acrimonious, or when their surface is inflamed. It is hence an esteemed remedy in all kinds of hoarseness, sore-throat, and cough, in gonorrhœa, in catarrh of the urinary bladder and other irritations of the genito-urinary mucous membrane, in dysentery and diarrhœa, and in irritant poisoning. The prevalence of the doctrines of Broussais, as to the frequency of gastric irritation in general fever and many local diseases, has led to a great extension of the uses of gum in France both as a demulcent and as a

mild nutrient. It is a most important substance in pharmacy for giving a convenient form to many drugs. Its powder is used in making the *Pulvis cretæ compositus*, *Pulvis cretæ cum opio*, and *Pulvis tragacanthæ compositus* of the three Pharmacopœias, and the *Confectio* (L.) or *Conserva* (E.) *amygdalarum*. Its mucilage is in extensive use for making pills; but it ought not to be employed except in extempore prescriptions, and only then if the pills are to be soon consumed, because they speedily become hard when made with mucilage for the excipient. Hence gum has been abandoned for preparing all the pill-masses of the Pharmacopœias with the exception of the *Pilulæ ipecacuanhæ compositæ* of the London College. The most important of the uses of mucilage of gum-arabic in Pharmacy is in compounding mixtures and emulsions; for which it is peculiarly fitted by its thickness, viscidity, and freedom from taste. It forms part of the *Mistura acaciæ*, E. or *Emulsio arabica*, D. *Mistura amygdalarum*, E. L. *Mistura cretæ*, E. L. D. *Mistura guaiaci*, E. L. and *Mistura moschi*, L. No other substance is so frequently used for mixtures in extempore prescriptions. It is used especially for administering insoluble substances in water, such as oils, fixed as well as volatile, resins, balsams, camphor, musk, &c.; which it enables the druggist both to divide finely, and then intimately to suspend in the form of emulsion. Lastly, it is an essential ingredient of many lozenges, both on account of its own demulcent properties and likewise to impart due consistence. Hence it forms part of the *Trochisci acaciæ*, *cretæ*, *glycyrrhizæ*, *lactucarii*, *opii*, and *sodæ bicarbonatis* of the Edinburgh Pharmacopœia. The preparations in general use for obtaining the demulcent action of gum-arabic are the emulsion or mixture of the Edinburgh and Dublin Colleges, and the lozenges of the former. Another convenient form in cough, hoarseness, and sore throat is that of Jujube, which is not officinal, but which is commonly made with sugar and gum-arabic for its basis, instead of the juice of the jujube-berry.

The *Mistura acaciæ*, E. *Emulsio arabica*, D. and the *Trochisci acaciæ*, E. may be given *ad libitum*.

HAEMATOXYLON, *E.* HAEMATOXYLUM, *L. D.* *Wood of Hæmatoxylon Campechianum*, *L. W. DC. Spr.* *Logwood.*

DECOCTUM HAEMATOXYLI, E. D.

PROCESS, *Edin. Dub.* Take of Logwood chips, an ounce (and a half, D.) Cinnamon in powder (bruised, D.) a drachm. Water a pint (two old wine pints, D.) Boil the logwood in the water to ten fluidounces (a pint, D.), adding the cinnamon towards the close; and strain.

EXTRACTUM HAEMATOXYLI, E. L. D.

PROCESS, *Edin. Lond.* Take of Logwood in fine chips, a pound (two pounds and a half, L.) Boiling water, 1 gallon (2 gallons, L.) Macerate for twenty-four hours, then boil down to four pints (a gallon, L.), strain and concentrate in the vapour bath to the due consistence.

PROCESS *Dub.* To be prepared from logwood-chips like extract of gentian.

FOR. NAMES.—*Fren.* Bois de Campêche.—*Ital.* Campeggio.—*Span.* Campe-

che.—*Port.* Pao de Campache.—*Ger.* Kampeschenholz; Blutholz.—*Swed.* Kampecheträd.—*Dan.* Kampesketräet.—*Russ.* Lazorevoe derevo.
FIGURES of Hæmatoxylon campechianum in Nees von E. 342.—Hayne, x. 44.

LOGWOOD (Campeachy-wood) was known in the art of dyeing soon after the discovery of the New World, but was not employed in medicine till about the middle of last century.

Natural History.—It is the inner wood of *Hæmatoxylon Campechianum*, a plant of the Linnæan class and order *Decandria Monogynia*, and of the Natural family *Leguminosæ* or *Fabaceæ*, a native of Campeachy in the province of Yucatan in Central America, and now growing also in Jamaica and other islands of the West Indies. It is a crooked tree, forty or fifty feet high, with a stem about eight inches in diameter. The alburnum of the wood is yellowish, and the inner wood dingy-cherry-red. The inner wood is the officinal part. It is imported in billets, which are close-grained, heavy, hard, and tough. They are cut into chips for the use of the dyer and druggist. It has a weak, somewhat violaceous odour, and an astringent, sweetish, but subsequently bitterish taste. It colours the saliva violet, when chewed.

Chemical History.—Water and alcohol extract its colouring matter, forming deep purple solutions. The watery solution yields a fine blue precipitate with lime-water, acetate of lead, or alum, a deep violet-blue with the salts of sesquioxide of iron, and curdy flakes with solution of gelatin. Water is used by the Colleges for obtaining the only officinal preparations of logwood, the *Decoctum* and *Extractum hæmatoxyli.* A pound yields two ounces of extract (Geiger). Logwood contains, besides a large proportion of lignin, a little resin, volatile oil, extractive matter, numerous salts, and a crystalline, colouring principle called Hæmatin (Chevreul), or more correctly Hæmatoxylin. This is sometimes found crystallized in crevices of the wood (Scanlan). It is best obtained by treating the dry commercial watery extract with ether, distilling off the ether till a syrupy fluid remains, and then adding a little water. Crystals form in a few days, and more are deposited as the fluid evaporates spontaneously. These, when purified by washing them with water, constitute the principle Hæmatoxylin. They are of a pale straw colour in their natural state, but become reddish-yellow by exposure to air containing the least trace of ammonia, or, even in close vessels, to bright sun-light. The constitution of dry Hæmatoxylin is $C^{20} H^{17} O^{15}$. It is neither astringent nor bitter to the taste, slightly soluble in cold water, readily in boiling water, alcohol, and ether [Erdmann]. It possesses many interesting chemical relations, which it would be out of place to detail here.

Actions and Uses.—Logwood was introduced into medical practice during last century, chiefly through the recommendations of Pringle and Alston, as a tonic astringent in chronic dysentery and diarrhœa; for which disease it is undoubtedly serviceable. In Germany it has even had some reputation as a febrifuge. The

decoction of the Edinburgh and Dublin Colleges, its best form, may be given without addition; and the Extract of the Edinburgh and London Colleges is administered simply in the form of pill. The urine becomes red under its use.

The doses of its preparations are; *Decoctum Hæmatoxyli*, E. D. unc. ii. ad unc. iv. *Extractum Hæmatoxyli*, E. L. gr. x. ad scr. i.

HELLEBORUS, *E. L. D. Root of Helleborus niger, L. W. DC. Spr. Black Hellebore; Christmas-rose (Edin. Dub.) Root of Helleborus officinalis, Sibth. Fl. Græca. Oriental or True Hellebore (Lond.)*

HELLEBORI TINCTURA, L. D.

PROCESS, *Lond. Dub.* Take of Black-hellebore-root, 5 ounces (4, D.) Proof-spirit, two pints (old wine measure, D.) Macerate for fourteen (seven, D.) days; and then filter.

FOR. NAMES.—*Fren.* Hellébore; Rose de Noël.—*Ital.* Elleboro nero.—*Span.* Heleboro negro.—*Port.* Helleboro negro.—*Ger.* Schwarze nieswurz; Schneerose.—*Dut.* Zwart nieskruid.—*Swed.* Schwart prustrot.—*Dan.* Sort nyserod.—*Russ.* Tschernaia tschemeritza.—*Arab.* Kherbeck aswed.—*Pers.* Kherbeck siya.—*Tam.*—Kadagaroganie.

FIGURES of Helleborus niger in Hayne, i. 7, 8.—Nees von E. 393.—Roque, 124.—Steph. and Ch. i. 11,—and of H. officinalis as Helleborus orientalis in Hayne, i. 2.—Roque, 123.—Steph. and Ch. ii. 87.

HELLEBORE owes its continuance in the British Pharmacopœias rather to its classic celebrity than to its modern reputation.

Natural History.—The ancient Hellebore has been ascertained by Sibthorpe to have been the root of his *Helleborus officinalis*, more commonly known to botanists by Willdenow's name, *H. orientalis*. This is a native of various parts of Greece, as well as the Levant. It belongs to the Natural family *Ranunculaceæ*, and to the class and order *Polyandria Polygynia* in the Linnæan arrangement. It is a herbaceous plant, with a perennial root of a dark brownish-black colour externally. It is little seen in Western Europe. The fact of its being the true ancient hellebore is not a sufficient reason for the recent adoption of it by the London College instead of the *H. niger*, which for centuries has displaced it in European practice. Besides the two species seem identical in their properties. The *H. niger*, a native of the hilly parts of Austria, Switzerland, and the south of France, is much cultivated in the gardens of this country, because it is one of the few plants which flower in winter. It flowers between December and February, whence it is called the Christmas-rose. The plant is herbaceous and low, the flower large and white, the leaves digitated, and the root composed of a black root-stock and numerous undivided radicles. These radicles, the only officinal part of the plant, are dark brownish-black externally, whitish within, spongy, not woody, brittle, and about the thickness of a straw. They have a faint bitter

taste. I have not been able to observe in February the acrid taste ascribed to the fresh roots by most authors; and nevertheless severe griping was occasioned in myself and others two hours after tasting them. They are said to lose acridity by drying; and certainly the dried radicles are not acrid to the taste. Little success has hitherto attended the efforts of chemists to detect the active principle of hellebore-root. Feneuille and Capron found in it an acrid concrete oil united with a volatile acid, the latter of which is probably the source of its activity.

Actions and Uses.—Hellebore is a powerful poison, which in animals occasions vomiting, purging, and other signs of irritation in the alimentary canal, and likewise giddiness, convulsions, and coma; but in man its irritant action is the only manifest effect of poisonous doses. Medicinally, it is a drastic cathartic, diuretic, anthelmintic and emmenagogue. As a cathartic its action is so irregular, often so violent, and always so apt to be attended with severe griping, that it has been abandoned entirely in modern practice. Nevertheless, it was the favourite purgative of the Greek physicians, and was prized especially in apoplexy and palsy, in hypochondriasis, insanity, and dropsy. Its anthelmintic virtues, as well as its power of restoring the menstrual secretion, at one time generally confided in, are probably nothing more than the secondary results of its cathartic action. It may be mentioned, that Dr Mead entertained a favourable opinion of it as an emmenagogue; and that M. Barbier maintains it has a soothing influence over the brain and nervous system,—which effect, together with its cathartic virtues, may render it better fitted for regulating the bowels in diseases of the brain than modern prejudice is inclined to admit.

All the other species of *Helleborus* which have been hitherto examined, seem to possess the actions of *H. niger* on the animal body. Both the *H. viridis* and *H. fœtidus,* which are indigenous, possess probably even more activity, and were at one time articles of the British Materia Medica.

The doses of the preparations of hellebore are as follows: *Hellebori pulvis,* E. L. D. gr. v. ad gr. x. *Tinctura Hellebori,* L. D. fl. dr. i. ad fl. dr. ii.

HERACLEUM, *D.* See *Ammoniacum.*

HIRUDO, *L.* *Hirudo medicinalis.* *The Leech.*

For. Names. *Fren.* Sangsue. *Ital.* Mignatta; Sanguisuga.—*Span.* Sanguijuela. —*Port.* Sanguisuga. —*Ger.* Blutegel.—*Dut.* Bloedzuger.—*Russ.* Piavitza.—*Arab.* Kheraheen —*Pers.* Zeloo.—*Tam.* Attei.

The period at which the medicinal leech first came into use in medicine is unknown. Cœlius Aurelianus, who probably preceded Galen, mentions it as having been employed in his time as a substitute for cupping; but it is not noticed in the writings of the more classic authors in ancient medicine.

Natural History.—The leech belongs to the class of *Vermes* and order *Annulata* in the zoological arrangement. The London College admits only one species as officinal, the *Hirudo medicinalis* of Linnæus. Naturalists, however, are generally of opinion, that at least two species may be distinguished among the leeches of commerce; and these have been characterized by Savigny under the designations of *Sanguisuga officinalis* and *S. medicinalis*. Both have a soft extensile body composed of about 98 rings. They vary in length from an inch and a half to six inches when in repose, but can contract themselves to a third of their length, and stretch themselves out to nearly the double of it. They present along the back and flanks six continuous or interrupted stripes of a rusty or greenish-yellow colour, by which they are easily distinguished from all other species that resemble them. They are smaller towards the head than towards the tail. They can attach themselves by both ends to adjacent objects by means of a particular apparatus. The *Sanguisuga medicinalis* is distinguished by a dark brown or greenish-brown back, with rusty stripes generally spotted with black, and a grayish or yellowish belly also more or less speckled with black spots. The *Sanguisuga officinalis* has a paler, greenish-black back, less bright and unspotted stripes, often interrupted and intercommunicating, and a paler, more yellowish or greenish unspotted belly. The former, commonly called the English leech, is a native of Britain, Germany, Poland, Sweden, northern France, and European Russia. The latter, usually known as the Hungary leech, is a native of that country, and likewise of the south of France. Both species have three converging mandibles, furnished at their edge with minute, sharp teeth, from 69 to 71 in number in each jaw in the Hungary leech, and from 79 to 90 in the other. By means of these teeth, when the skin is sucked into the mouth, it is pierced with a sawing motion, so as to present three incisions meeting in a common centre. These incisions often penetrate through the whole thickness of the integuments into the cellular tissue. The animal becomes filled with blood in the course of fifteen minutes, if it be vigorous, and draws about a drachm and a half. According to Kluge, the English leech, which weighs on an average 35 grains, draws, one with another, 39 grains of blood; while the Hungary leech, although it weighs only seven grains more, will draw 85 grains, or more than twice as much as the other. The latter, according to the same authority, is less delicate, bites more quickly, and causes more hemorrhage after it drops off. Many, however, object to the Hungary leech, that it is more apt than the other to be followed by inflammation; but this seems an unfounded prejudice. They are considered more delicate in this country.

Leeches thrive best in ditches and ponds which have a run of pure water, weeds in abundance for shelter, and a bottom of sandy mud. They are hermaphrodite. They do not become fruitful till they are six or seven years old. They produce from five to eighteen

ova at a time. These are deposited in oval cells, like the silk-worm coccoon, which are imbedded in the bottom or sides of their pond; and the young leeches are brought out in twenty-five days. They grow slowly, and are not fit to be used in medicine for several years. Leeches may be easily bred artificially in a stream-pond supplied with soft water, bordered with turf, lined with clayey sand, planted with lemnas, water-lilies, and potamogetons, shaded with shrubs around, and maintained at a temperature about 50° in the winter-time, which may be accomplished in this country with the waste-water of a neighbouring steam-engine. Leeches are caught in their native marshes in the spring by stirring up the muddy bottom, and taking them with a net, but sometimes also by men walking among them and allowing them to fix on their legs, which may be done without blood being drawn for some time. They were once largely imported into this country from France and Germany; but the increasing demand for them on the continent, occasioned by the spread of the doctrines of Broussais, has thinned the French localities for them, and rendered France no longer an exporting country. Britain is now supplied partly from Bordeaux and Lisbon, but chiefly through Hamburgh from Poland and the Ukraine. France is supplied from Hungary, Turkey, Wallachia, Russia, Egypt, and latterly also from Algeria. In Paris, where the commerce of leeches has been carefully attended to, they are divided according to their size into five sorts, called Great, Middling, Small-middling, Thread, and Cow-leeches. The average weight of these is 46, 19.3, 10.8, 7.7, and 141 grains. The last kind are worthless. The others are esteemed according to their size. The Great leech draws on an average 247 grains of blood, the Middling 129 grains, the Small-middling 51, and the Thread leech only 19 grains. In 1845 the price of the first was from four to eight pounds Sterling the thousand, of the second from two pounds sixteen shillings to six pounds, and of the third from two pounds to three pounds ten shillings (Chevallier).

Spurious leeches are sometimes substituted for the genuine species hitherto described. The only fraud of this kind deserving particular notice is the substitution of the horse-leech, the *Hirudo sanguisuga* of Linnæus, *Hirudo Gulo* of Braun, or *Hæmopus sanguisorba* of Savigny. Various unfounded prejudices prevail respecting this animal. It is generally thought to have a great tendency to excite inflammation; in Scotland the vulgar imagine it will bleed a person to death, because the blood runs out at the tail as fast as it is sucked in at the mouth; in Germany the common people think nine of them sufficient to kill a horse; while Dr Duncan on the other hand says it may be used without any bad consequences. But the real fact is, that its jaws are provided only with blunt teeth; and both Pelletier in France, and Leucradt, as well as Kluge, in Germany, have ascertained, that it cannot perforate the human skin at all. It is easily known by its back being without rusty bands,

or presenting two only.—The gorging of leeches is a more common fraud than the substitution of spurious species. They are known by being less velvety in their coat, less flat when pressed, and by presenting a little tumour when squeezed between the fingers from the head to the tail.—Leeches which have been used are often sold for unused or Virgin leeches. These are best known by putting them on a white cloth, dusting their fore part with finely powdered salt, and then putting more salt on the anus and mouth, as they elongate themselves to escape. In thirty seconds a little blood will be emitted, but not a particle if the leech be quite fresh (Jourdan).

Leeches are troublesome to preserve on the great scale. The best method probably is to keep them in loose turf or moss, maintained constantly moist, and packed in vessels which admit of a free renewal of air. They may also be preserved in earthen-ware or green-glass bottles, half-full of water, and lightly covered with coarse linen or fine gauze. The water, which must be pure and soft, ought to be renewed every three or four days after they are newly imported, but subsequently once a fortnight. The temperature should be maintained as uniform as possible; it ought never to descend below 50°; and sudden changes must be carefully avoided. The vessels should be kept where the air is pure, and all strong odours ought to be excluded from the apartment. Dead or sickly leeches must be promptly removed from the general receptacle. With these precautions they may be preserved in an active state for many months without any food. But notwithstanding all the care that can be taken of them, they are subject to epidemic diseases which sweep them off in great numbers. One affection renders them warty over the whole body; another on the contrary makes them very slimy and fills the water with their mucus; a third turns them yellow; and all of these disorders may carry off thousands at a time when they are stored in great numbers.

It is often difficult to get leeches to fasten quickly and uniformly on the skin. Every nurse has her nostrum for the purpose, none of which is singly of great service. In the first place active leeches should be chosen, if possible. A skilful person can do this to a certainty. In a trial made by Chevallier, a Paris leech-merchant chose ten of the four sorts recognized in French trade; and the whole forty fastened at once, filled themselves expeditiously, and drew the large quantities of blood mentioned in the last page. It is obvious therefore, that, with due skill and attention on the part of druggists, an amazing improvement might be effected in this department of the medical art. For in three cases out of four the operation of leeching is at present tedious, irksome, and unsatisfactory. The usual way to choose leeches is to take a handful out of the jar where they are stored, and to squeeze them suddenly, but gently, in the hand,—when the most active will be found to have contracted themselves into a wrinkled oval ball. These being selected, they should

be kept for an hour out of water before they are used. If they be then held in a clean towel, and not in the warm hand, and if the skin be previously quite clean, they will generally fix at once. Inferior leeches may be often made to bite by smearing the part with cream, or with blood; and when these means fail, they will sometimes fix after being immersed for about a minute in porter. There are some states of the body however in which the leech will not fix at all, or speedily perishes if it does. This has been observed in poisoning with nux vomica, or with oxalic acid, or where the patient has been using sulphureous remedies.

An important object in the management of leeches is to render them soon serviceable again after they have sucked. Unless they be stripped of the blood they have swallowed, they will not answer again for more than six months. The usual method therefore is to strip them gently between the fingers, after sprinkling a few grains of salt on their heads to make them sick,—and to place them by themselves in pure water, which is renewed twice a-day for some time on account of the large quantity of mucus thrown off from their bodies. It is in general long however before such leeches will again draw blood freely; a large proportion of them perish; and few ever suck vigorously a second time. It has been stated that they may be rendered in a few days as active and useful as ever by dissolving a little white sugar in the water, and renewing this solution twice at intervals of twelve hours and twice afterwards at intervals of a day. I have tried this plan, and found that the same leeches drew blood three times at intervals of three days, with scarcely any diminution of activity, and without a death among them. Another method lately recommended is to strip them without extending the pressure so far as the head,—to put them into a vessel with half an inch of sand at the bottom, and containing water with two tea-spoonfuls per quart of French white-wine,—and to change the liquid daily till the fourth day, when pure water is to be substituted (Boer). It would probably be an improvement in the management of all leeches that have been once used, were they so placed as to have occasionally an opportunity of quitting the water in which they are preserved, and creeping on turf, moss, or some similar moist substance, so as to free themselves more easily of the mucus secreted on their skins.

Uses.—Leeches may be applied to any part of the integuments of the human body. They may also be applied to the nostrils, fauces, gums, or interior of the anus or vagina; and to prevent them from creeping out of reach, it is usual to introduce them into a tube constructed for the purpose, or to restrain them by means of a thread passed through the posterior part of the body with a fine needle. When they have all dropped off, the hæmorrhage may be kept up for an hour and upwards by fomenting the part, or, more conveniently for the patient, by a succession of poultices. Twice as much blood may be usually withdrawn by fomentations as by the

suction of the leech. A single leech, when applied successfully, may thus be held to draw from first to last about half an ounce of blood on an average; but were the best sort, called Great leeches, alone used, at least twice that quantity might be counted on.

Several inconveniences are occasionally apt to arise from their employment. Sometimes the hæmorrhage is with difficulty controlled, especially from the scrotum, or in children from all parts, but especially from the abdomen or neck or any place upon which firm pressure cannot be applied. I have twice known children bled to death in this way in hospital practice, the nurses having laboured under a common prejudice among their craft, that leech-bites cannot bleed too much; and I have thrice known strong men bled to fainting by hæmorrhage from leech-bites on the scrotum, whence the blood ran as from the orifice of a vein in ordinary blood-letting. Some think that pressure will always arrest such hæmorrhage (Pereira); but in certain cases it is evidently impossible to apply adequate pressure. It then becomes necessary to staunch the hæmorrhage with vinegar, or with a strong hot solution of alum thrust into the wounds on a pointed cylinder of hard-rolled linen, or with a red-hot wire, or with a pointed rod of lunar caustic, or by stitching up the wound with a fine sewing-needle. As a general rule however, leeches ought not to be applied in young children upon soft parts destitute of firm support underneath, such as the abdomen or neck; and on all occasions the operation of leeching should be watched in children, because the incisions may penetrate little arteries.——Another inconvenience is the production of erythema, subcutaneous serous effusion, and even erysipelas. These results have been vaguely ascribed to the leeches having been poisonous, or to the teeth being left in the wound in consequence of the leech having been roughly detached. Their real cause is obscure. But they are of little consequence, and for the most part disappear in a few days. Erythema with subcutaneous effusion is peculiarly apt to arise when a leech is allowed to fasten on the loose integuments on or near the eyelids.——Leeches have been sometimes carelessly allowed to creep up the nostril, down the gullet into the stomach, or up the rectum. Great alarm is thus occasioned, and the accident is not without danger, because the animal may make various incisions before it is discharged, and the wounds, if in the stomach or rectum, are slow to heal. The best remedy is a strong solution of common salt, which acts as a speedy poison to the leech.

HORDEUM, *E. L. D.* *Decorticated seeds of Hordeum distichon, L. W. Spr.* *Pearl-barley.*

DECOCTUM HORDEI, L. D.

PROCESS, *Lond. Dub.* Take of
Pearl-barley, two ounces and a-half (two ounces, D.);
Water, four pints and a-half (old m. D.)
Wash away adhering impurities from the seeds; boil them for a little in half a pint of water (to remove colouring matter, D.) Throw this away; add the remaining water, boiling hot; concentrate to two pints, and then strain.

DECOCTUM HORDEI COMPOSITUM, L. MISTURA HORDEI, E.

PROCESS, *Lond.* Take of
Decoction of barley, two pints;
Figs, sliced, two ounces and a half;
Liquorice-root, sliced and bruised, five drachms;
Raisins, two ounces and a-half;
Water, one pint.
Boil down to two pints; and then strain.

PROCESS, *Edin.* Take of
Pearl-barley,
Figs sliced, and
Raisins, stoned, of each two ounces and a-half;
Liquorice-root, sliced and bruised, five drachms;
Water, five pints and a-half.
Clean the barley if necessary by washing it with cold water; boil it with four pints and a-half of the water down to two pints: add the figs, raisins, and liquorice-root, with the rest of the water; boil down again to two pints; then strain.

FOR. NAMES.—*Fren.* Orge.—*Ital.* Orzo.—*Span.* Cebada.—*Port.* Cebada.—*Ger.* Gerste.—*Dut.* Garst.—*Swed.* Korn.—*Dan.* Byg.—*Russ.* Yatschmen.—*Arab.* Shaeer.—*Pers.* Juo.

Hordeum vulgare and H. hexastichon figured in Nees von E. 29, 30.

BARLEY is one of the articles of the ancient Materia Medica, being the Κριθη of Dioscorides.

Natural History.—The native country of the plant is not yet known; but it is presumed to have been originally an inhabitant of Central Asia, and was lately seen growing wild in Mesopotamia by Captain Chesney. It is an annual, belonging to the Natural family *Graminaceæ*, and to Linnæus's class and order *Triandria Digynia.* Various species of barley are cultivated in different parts of the world, more especially *Hordeum distichon, vulgare*, and *hexastichon;* which are readily distinguished from each other by having the seeds arranged upon the ear, the first in two, the second in four, and the third in six rows. *H. distichon*, as being the kind generally cultivated in this country, has been adopted for the officinal species by the British Pharmacopœias. At one time the whole plant was used in medicine; but the only part now employed is the seed.

When barley, as sold by the farmer, is stripped of its husk and rounded somewhat by a particular process, it constitutes Pearl-barley. This ground to the state of coarse flower forms Barley-meal. And when the entire grain is moistened and exposed to a summer temperature till it begins to germinate, and is then killed by a stronger heat, it forms Malt. In all these shapes barley is an important dietetic article; but the decorticated seed in the shape of Pearl-barley is the only form acknowledged as officinal by the British Colleges.

Chemical History.—Ripe barley in the rough state, according to the analysis of Einhof, consists of nearly 19 per cent of bran, 11 of hygrometric moisture, and 70 of flour. The same chemist found the flour to be composed of 67.2 per cent of starch, 5.2 of uncrystallizable sugar, 4.6 of gum, 3.5 of gluten, 1.15 of albumen, 7.3 amylaceous lignin, a little earthy matter, and about 11 per cent of moisture. But Proust was led to consider that a large proportion of what Einhof regards as starch is really a distinct principle of allied, yet peculiar properties, which he accordingly

termed Hordeïn. This he obtained by boiling the starchy matter which is obtained by kneading barley-meal in a cloth with water. The undissolved residuum when well washed with boiling water is his pure hordein. It is a yellowish granular powder, like sawdust, which yields oxalic acid when treated with nitric acid, and to which Marcet assigned the composition of 12 equivalents of carbon, 11 of hydrogen, and 10 of oxygen. But it does not seem to be a distinct principle at all. Of the various opinions held concerning it, that of M. Guibourt and Dr Thomson seems most correct, that it is the amylin or tegumentary membrane of the starch-globules, which in barley starch is more strong and solid than in other kinds of starch.

Barley, like other grains, is resolved into its proximate constituents by kneading in cold water. Boiling water dissolves a large proportion of it, and, among other principles, its starch. A mucilaginous decoction is obtained, which becomes thickish on cooling, and is then acted on by iodine like decoction of wheat-starch. This is the *Decoctum hordei* of the Pharmacopœias, a familiar domestic article of the Materia Medica under the name of barley-water. When boiled with various saccharine substances it forms the *Decoctum hordei compositum*, L. or *Mistura hordei*, E. an article equivalent to some of the sweet ptisanes or diet-drinks of the French, and esteemed as a pleasant mucilaginous diluent since the days of Hippocrates. Barley is insoluble in alcohol, ether, or the fixed and volatile oils; but alcohol and ether remove from it a little resin. Singular changes are induced in it by the process of germination. When exposed in the moist state to a temperature between 60° and 80° the grain speedily swells and begins to shoot. At the same time a material change takes place in its proximate composition. Proust, who examined this subject carefully, conceived that this change consists in a great part of his principle hordein being transformed into starch, while a portion of the starch passes into sugar and gum; so that the gum is increased from 4 per cent before germination to 15 per cent after, the sugar from 5 to 15, the starch from 32 to 56, while the hordein is diminished from 55 to only 12 per cent. The more recent inquiries of MM. Payen and Persoz show, that the first change during the process of germination consists in rupture of the starch-globules, and the separation of their tegumentary amylin from the contained amidin (see *Amylum*); that this is followed by conversion of the amidin into sugar and gum: and that these alterations are caused by the action of a peculiar proximate principle which is developed at the time in the seed, and which they have named Diastase (from διαστημι), on account of its effect in detaching the principles of the starch-globules from one another.

This principle, which is susceptible of various useful economical applications, may be obtained by moistening ground malt with half its weight of cold water, mixing the expressed liquid with just enough of rectified spirit to destroy its viscosity, filtering it, and then adding spirit freely. Impure diastase is thus precipitated;

and it may be purified by three successive solutions in water and precipitations by spirit; after which it is best obtained in the dry state by exposing it in thin layers to a current of air about the temperature of 110°. Diastase when pure is solid, white, and amorphous, insoluble in alcohol, soluble in water and in weak spirit, tasteless, and neutral. Its watery solution is not precipitated, like that of starch, by lime, baryta, or diacetate of lead; and it becomes acid by keeping. It does not exist in the grains prior to germination; but may then be found in wheat, barley and oats. It also exists around the points of insertion of the roots into the tubercles of the potato, but not in the roots-proper or in the shoots of the plant. Its most remarkable property is its relation to starch. When brought in contact with starch and water at a temperature between 150° and 175°, in the minute proportion of a two-thousandth part of the starch, it speedily causes the starch-globules to burst, and separates the tegument from the contained amidin; and by prolonged action at the same temperature it converts the amidin entirely into sugar and gum, without any difference taking place in the weight of the materials employed.

It was stated above that the same chemical changes, now detailed as resulting from the action of diastase upon starch at an elevated temperature, are also induced by it during the germination of the different kinds of grain. It has been found by experience, that in the case of barley the greatest amount of change, with the least loss of material, is accomplished when the young plant is about as long as the grain or a trifle longer. In the process of making malt the vitality of the seed and plant is destroyed at this point by raising the temperature to 160°. Malt has a pleasant, sweetish, mucilaginous taste. An infusion of it made at a temperature between 150° and 176°, so as to complete the conversion of the starch into sugar and gum, if subjected to the action of yeast at a temperature between 60° and 80°, undergoes the vinous fermentation, carbonic acid being disengaged and alcohol formed. In this way are produced, with the conjunction of hops and other articles, the different kinds of beer, ale, and porter. The sugar of the altered starch is the sole source of the alcoholic impregnation of these liquors; and the gum, which is likewise formed from the starch, is the cause of their viscosity and the permanence of their effervescence and frothy top, compared with other effervescing vinous liquors.

Actions and Uses.—Barley is a very nutritive substance, which is freely used as food in a variety of familiar shapes. As an article of farinaceous food it enjoys, not without reason, the reputation of having a tendency to keep the bowels open; and on this account many are in the practice of using it in the form of barley-meal bread or porridge. On account of its comparatively small proportion of azotiferous principles, amounting in all to about four and a half per cent, it is usually held to be less nutritive than wheat, and by many is regarded as less digestible. In the officinal form

of simple or compound decoction it is a useful demulcent. The simple decoction is much used in regular as well as domestic practice, both for suspending drugs insoluble in water which are administered in the form of powder, and likewise as a demulcent drink in febrile diseases, especially catarrh, dysentery, and inflammation of the bladder. For these purposes however the compound decoction is preferred by some. Its more luscious taste renders it less palatable in febrile disorders; but it is a good demulcent drink in chronic catarrh, chronic dysentery, and gonorrhœa. In the form of beer, porter, and ale barley becomes a valuable article of the Materia Medica, on account of the applications of these various liquors to the treatment of exhausting chronic diseases, and convalescence from diseases at large. Some remarks on their respective qualities as drink will be found under the article *Vinum*.

HUMULUS LUPULUS, *D.* See *Lupulus*.

HYDRARGYRUM, *E. L. D.* *Mercury.* *Quicksilver.*

TESTS, *Edin.* Entirely sublimed by heat: a globule moved along a sheet of paper leaves no trail; pure sulphuric acid agitated with it evaporates when heated without leaving any residuum.

TESTS, *Lond.* Entirely vaporizable; soluble in diluted nitric acid, but not in boiling hydrochloric acid; the latter after being boiled with it and cooled, is neither coloured nor precipitated by hydrosulphuric acid. Density 13.5.

HYDRARGYRUM PURIFICATUM, D.

PROCESS, *Dub.* Take six parts of mercury, and draw off four by the process of distillation.

HYDRARGYRUM CUM CRETA, L. E. D.

PROCESS, *Edin. Lond.* Take of
Mercury, three ounces;
Prepared chalk, five ounces;
Triturate them together till the globules disappear.

PROCESS, *Dub.* Take of
Purified mercury and
Manna, of each two parts;
Prepared chalk, one part.
Triturate the mercury and manna in an earthen-ware mortar, adding a few drops of water to impart the consistence of syrup. When the globules disappear, add an eighth of the chalk, continuing the trituration. When the mixture is complete add sixteen parts of hot water; agitate; and when the mixture has rested till the sediment falls, pour off the liquid; repeat the washing once and again, to remove all the manna. While the sediment is moist, mix with it the rest of the chalk, and dry the powder on blotting paper.

HYDRARGYRUM CUM MAGNESIA, D.

PROCESS, *Dub.* To be prepared with magnesia like the last preparation.

EMPLASTRUM HYDRARGYRI, L. E.

PROCESS, *Edin.* Take of
Mercury, three ounces;
Litharge-plaster, six ounces;
Olive-oil, nine fluidrachms;
Resin, an ounce.
Melt the resin and oil, let them cool, add the mercury, triturate till the globules disappear, add the plaster previously melted, and mix the whole well.

PROCESS, *Lond.* Take of
Mercury, three ounces;
Litharge-plaster, twelve ounces;
Olive oil, a fluidrachm;
Sulphur, eight grains.
Add the sulphur gradually to the oil previously heated, stirring constantly till they unite. Triturate the mercury with these till its globules disappear. Add gradually the plaster melted with a gentle heat; and mix them.

EMPLASTRUM AMMONIACI ET HYDRARGYRI, E. L. D.

PROCESS, *Lond. Edin.* Take of
Ammoniac, a pound ;
Mercury, three ounces ;
Olive oil, one fluidrachm ;
Sulphur, eight grains.
Proceed as in the London process for Emplastrum Hydrargyri, substituting ammoniac for litharge-plaster.

PROCESS, *Dub.* Take of
Ammoniac, a pound ;
Mercury, three ounces ;
Common turpentine, two drachms.
Triturate the mercury and turpentine till the globules disappear ; add gradually the ammoniac melted ; triturate with a gentle heat till the materials unite.

LINIMENTUM HYDRARGYRI, L.

PROCESS, *Lond.* Take of
Strong mercurial ointment, and
Lard, of each four ounces ;
Camphor, an ounce ;
Rectified-spirit, a fluidrachm ;
Aqua ammoniæ, four fluidounces.
Triturate the camphor with the spirit, then with the lard and ointment ; finally drop in the solution of ammonia by degrees, and mix the whole ingredients.

PILULÆ HYDRARGYRI, L. E. D.

PROCESS, *Edin. Lond. Dub.* Take of
Mercury, two parts ;
Liquorice-root, one part ;
Conserve of red-roses, three parts ;
Beat the mercury and conserve till globules can no longer be detected ; add the liquorice-root ; and beat the whole again into a proper mass (which is to be divided into five-grain pills, E.)

UNGUENTUM HYDRARGYRI, E. D. UNGUENTUM HYDRARGYRI FORTIUS, L.

PROCESS, *Edin. Lond. Dub.* Take of
Mercury (purified, D.), two pounds ;
Axunge, twenty-three (twenty-four, D.) ounces ;
Suet, an ounce (none, D.)
Triturate the mercury, with (the suet and, E. L.) a little of the axunge till globules are no longer visible ; then add the rest of the axunge and mix the whole thoroughly. (This ointment is not well prepared so long as metallic globules may be seen in it with a magnifier of four powers.

The ointment with these proportions may be diluted at pleasure with twice or thrice its weight of axunge. *Edin.*)

UNGUENTUM HYDRARGYRI MITIUS, L. D.

PROCESS, *Lond.* Mix together one pound of strong mercurial ointment and two pounds of lard.

PROCESS, *Dub.* To be made with twice as much lard as the last.

CERATUM HYDRARGYRI COMPOSITUM, L.

PROCESS, *Lond.* Take
Stronger mercurial ointment, and
Soap-cerate, of each four ounces ;
Camphor, an ounce ;
Beat them together into a uniform mass.

FOR. NAMES.—*Fren.* Mercure.—*Ital.* Mercurio ; Idrargiro ; Argento vivo.—*Span.* Azogue.—*Port.* Azougue.—*Ger.* Quecksilber.—*Dut.* Qwikzilvr.—*Swed.* Qwicksilfwer.—*Dan.* Qviksölv.—*Russ.* Rtut ; Jivoe serebro.—*Arab.* Abuk ; Zibakh.—*Pers.* Seemab.—*Tam.* Rasam.

MERCURY, or Quicksilver, has been known from remote antiquity. It was the Ὑδράργυρος of the Greeks and *Hydrargyrum* of the Latins.

Natural History.—It is produced in various parts of the world, but chiefly for European commerce in Idria, Spain, and South America. It exists abundantly in the metallic state, especially in the mines of South America; and it is mineralized by chlorine, by sulphur, and by sulphur with carbon,—forming the horn quicksilver, cinnabar, and liver of mercury of mineralogists. From cinnabar it is obtained by distillation with iron or lime; and native mercury is separated by simple distillation from the impurities which accompany it.

Chemical History.—The mercury now imported into Britain is

generally pure enough for medicinal and pharmaceutic purposes; but sometimes it contains a sufficient admixture of other metals to render purification necessary. There is no better way of accomplishing this than by distilling it. For the security and success of the process, certain precautions must be attended to. The retort must be of iron in large operations, though on the small scale green glass retorts answer very well; it should be about thrice the capacity of the mercury put into it; and there is advantage in covering the mercury with a layer of iron-filings, to prevent the impure metal from being spurted over. The receiver should be partly filled with water; but the water must not touch the beak of the retort, otherwise the hot mercury is apt to crack it. The foreign metals most generally left behind are lead, tin, bismuth, and zinc. Another way of purifying mercury is by leaving it for some weeks in a thin layer covered by concentrated sulphuric acid, and stirring it frequently. The greater part of the impurities being thus dissolved, the mercury is subsequently obtained tolerably free of them by carefully washing it with water. Commercial quicksilver is now so pure before it reaches the druggist that these operations are seldom necessary; and the process of purification has therefore been expunged from the new editions of the Edinburgh and London Pharmacopœias.

Mercury is the only metal which is fluid at atmospheric temperatures. It has a pure silver-white colour and much brilliancy. It tarnishes under exposure to the air, but this change is commonly supposed to be produced, and is certainly promoted, by the presence of foreign metals. Its density is about 13.5, at 47° 13.545. It freezes at 40° below zero, and boils about 660°. When agitated long in contact with air, it forms a gray powder, which contains some oxide, and which some have supposed, but on insufficient grounds, to be a regular oxide of mercury. It seems probable that the same change is effected in some measure when the metal is triturated with viscid substances or powders, as in the preparation of the mercurial pill, ointment, plaster, and powders. This question, which is of sufficient practical importance to deserve attentive consideration here, is one as to which pharmacologists are divided in opinion.

When mercury is triturated with unctuous substances, viscid saccharine matters, or some powders, it undergoes what is called extinction: That is, it becomes a fine grayish-black or grayish-blue mass, in which globules cannot be recognized with the naked eye, or even with a magnifier of four or five powers. In this way are prepared various important pharmaceutic forms of the metal, viz. the *Hydrargyrum cum creta*, *Hydrargyrum cum magnesia*, *Emplastrum hydrargyri*, *Emplastrum ammoniaci et hydrargyri*, *Pilula hydrargyri*, *Linimentum hydrargyri*, and *Unguentum hydrargyri*. The preparation of these articles, and their precise nature, will be best understood by considering attentively in the

first instance the process for mercurial ointment, which has been the most carefully examined.

The preparation of the *Unguentum hydrargyri*, unlike that of other ointments, is a work of much time and labour; and doubts may be entertained, whether any of the recent improvements for saving either, but especially time, is quite admissible. When mercury is triturated with fresh lard or suet, considerable time and labour are required to extinguish the metal even so far that, when the ointment is spread thin upon paper, globules are no longer visible to the naked eye. This, however, is but the first step towards making a good ointment. For globules may be still discovered with a microscope of four or five powers; and so long as this continues to be the case, the ointment is imperfect. The farther division of the metal is not promoted by continuous trituration in a degree proportional to the labour, and is accomplished with less toil by triturating only for a short time once or twice a day,—the mixture being left exposed to the air in the intervals, and several weeks being allowed for completing the process. The globules in well made ointment do not exceed a 1500th of an inch in diameter [Grattan]. Various plans have been proposed for facilitating extinction. Some of these are inadmissible, because they yield an irritating ointment different from what is obtained by simple trituration. Of the other methods, which consist either in peculiarities of manipulation, or in certain simple modes of preparing the lard (see Duncan's Dispensatory), two only have appeared to me at once useful for the end in view, and allowable on the ground that they do not injure the quality of the product. These are, the plan proposed by M. Guibourt, and practised for a long time by various druggists in this country, of triturating the ordinary mixture with a sixteenth of its weight of old mercurial ointment; and the method of M. Simonin, who makes use of lard that has been exposed in thin layers to moist air for fifteen days about the temperature of 50°. In either of these ways the mercury may be promptly rendered invisible to the naked eye. I have not observed however that either of them will accomplish much more:—the subsequent step of complete extinction still remains tedious and laborious.

The making of mercurial ointment is in all circumstances an operation of so much toil, that in this country it is now seldom practised in the laboratory of the retail-druggist or practitioner, but is performed on the large scale by machinery. The materials are kept in the fluid state by a temperature about 100°, and are driven round with rapidity in a circular trough by two spherical iron balls, which are propelled by means of a steam-engine; and in this way extinction is accomplished in the course of twelve hours.

In mercurial ointment as thus prepared, the metal is not merely in a state of extremely fine division, but is also in part oxidated. Contradictory statements however have been made on this point, and the question is not yet settled, although the correct mode of

preparing the ointment probably depends on it. Many years ago Mr Donovan proved that four-fifths of the mercury in mercurial ointment is superfluous; for when this was removed by subsidence in the melted ointment, the superior stratum, containing only a fifth of the original mercury, was found by extensive trials to be as energetic as ever in exciting mercurialism. But he further inferred from various facts,—not however conclusive,—that a part at least of the mercury in the upper stratum exists in the state of oxide. M. Guibourt subsequently arrived at a different conclusion. For he found that not more than a 500th part of the ointment consists of a compound of oxide of mercury with a fatty acid; and his experiments have been confirmed by Mr Watt, who repeatedly failed to discover any oxide in the ointment of the shops. I have examined various samples during the last twelve years, and have only once failed to detect a sensible proportion of oxide. On keeping the ointment for thirty-six hours in a state of fusion and rest in a long tube, there is obtained a short column of mercury at the bottom, and a long superstratum of yellowish, almost perfectly transparent oil. Even when this is filtered for greater security, it becomes intensely black with sulphuretted hydrogen; and if agitated with successive portions of diluted acetic acid about the temperature of 150°, an acid liquor is obtained which gives a copious black precipitate of sulphuret of mercury with the same reagent. It is evident from these results that mercury must be present in the form of oxide combined with a fatty acid; and calculating from the weight of the sulphuret obtained, the oxide amounts to a trifle more than one per cent of the ointment, and consequently to a fiftieth of the mercury used in preparing it. I have seldom found less than this proportion, and sometimes a trifle more. The small proportion observed by *M. Guibourt* may be accounted for, if he made his ointment by his own process, in which the degree of trituration and length of exposure are materially reduced.

The results of these analytic experiments are confirmed by what will be stated subsequently of the action of mercurials on the animal body. It is far from improbable that the small proportion of oxide either present at first, or formed during the process of rubbing the ointment into the skin, is the only active part of the mercury. If so, the mercurial ointment, long as it has been used and without challenge, is nevertheless a clumsy preparation, and susceptible of material improvement.

The other apparently mechanical preparations of mercury have not been examined with much care. The *Linimentum hydrargyri*, L. is little else than a diluted ointment. In regard to the *Pilula hydrargyri* of the three Pharmacopœias, as well as the *Hydrargyrum cum creta* and *Hydrargyrum cum magnesia*, the inquiries hitherto made rather tend to show that they do not contain any oxide. But the reverse may be presumed, both from the mode of preparing them being somewhat similar to what is practised in mak-

ing the ointment,—and likewise from their activity as mercurials, compared with the inertness of mercury when unequivocally in the metallic state only. Accordingly one experimentalist, Mr Nevins, has found about three-quarters of a grain of oxide in 100 grains of the pill, and about half a grain in the same quantity of the powder with chalk. The *Emplastrum hydrargyri* and its combination with ammoniac are differently circumstanced. They are stimulant; but their power of inducing mercurial action is doubtful, and the developement of this effect in a few rare instances may be accounted for otherwise than by holding that mercury acts specifically in its metallic condition. They have not been carefully examined of late; but from the mode of preparing them it is probable that their mercury is almost entirely metallic.

Mercury, by repeated sublimation in contact with air, is slowly converted into a yellowish-red powder, which is a binoxide. It unites with chlorine in two proportions, forming a white insoluble chloride, and a colourless soluble bichloride. It forms with cyanogen a white, soluble bicyanide. It combines with iodine in three proportions, and produces a green iodide, a yellow sesquiodide, and a red biniodide, all of which are insoluble in water. With sulphur it constitutes a black sulphuret and a red bisulphuret. Its oxides combine with acids; but few acids can attack the metal. Nitric acid however dissolves it readily, either with or without heat, and forms in the cold a nitrate of the protoxide, and with the aid of heat a nitrate of the peroxide, both of which are crystallizable salts. Sulphuric acid does not act upon it at atmospheric temperatures; but, aided by gentle heat, it gradually accomplishes oxidation and solution, and forms a sulphate of the protoxide; while at a higher temperature brisk action takes place, peroxide of mercury is produced, and this unites in such proportion with the acid as to form a bisulphate. The other salts of mercury may be formed by double decomposition, from the protonitrate, pernitrate, and persulphate. Solutions of the salts of both the mercurial oxides are decomposed by the fixed alkalis, those of the protoxide yielding that oxide of a dark ash-gray colour, while the peroxide salts yield their base of a fine yellow tint. Ammonia acts on the same solutions quite differently, and forms double salts which will be described particularly under the heads of the black oxide and white precipitate (see *Hydrargyri oxidum nigrum* and *precipitatum album*). These are the chief chemical relations, through means of which are constituted the numerous compounds of mercury now admitted into the British Pharmacopœias.

Adulterations.—The adulterations of mercury have been already mentioned. They consist chiefly of the baser metals. The purity of mercury may be sufficiently detected, so far as its pharmaceutic uses are concerned, by one of the characters mentioned in the Edinburgh formula of tests,—the gray stain or trail left on white paper when a globule is moved to and fro upon it,—or by the formation

of gray powder when it is briskly shaken in a dry bottle. A very small proportion of the ordinary contaminating metals may be thus discovered. If however it be necessary to estimate the amount of the adulteration, a different plan must be followed; and the best is either agitation of the mercury with concentrated sulphuric acid unaided by heat, and the subsequent evaporation of the acid,—or distillation of the metal. Hydrochloric acid, as indicated by the London College, will also dissolve and separate some of the contaminating metals; and the nature and amount of the contaminations may be judged of approximately through means of sulphuretted-hydrogen gas. Neither of these acids will act on pure mercury in the cold, and sulphuric acid alone acts with the co-operation of heat.

Actions and Uses.—The Medicinal Actions and Uses of mercury in the metallic state are few and simple. But in the present place some account must be given of the physiological and therapeutic actions of mercurials generally, to save unnecessary repetition afterwards.

There is no other substance in nature which exerts so great a variety of actions on the animal body as mercury. Of these actions some are possessed by a few only of its preparations; others are common to many; and one action, the most peculiar of its properties, is possessed more or less by all its compound officinal forms.

It seems probable that the metal itself is destitute of all action except what depends on its mechanical properties. By many indeed this doctrine has been called in question, and they appeal to the specific effects induced by such preparations as the ointment, pill, powders, or vapour; in which they maintain that the mercury exists in the metallic state. It is a general law however in physiology, —to which it would be strange were mercury the sole exception,— that metals do not act as such, but must be first converted into oxides or salts. The presumption therefore is, that, where mercury seems to act in the metallic state otherwise than mechanically, it must have undergone oxidation in some way which escapes notice. Accordingly it has been found by Dr Samuel Wright (Unpublished Prize Thesis, Edinb. 1840), that the vapour disengaged from mercury at atmospheric temperatures contains some oxide; I have shown above that mercurial ointment also contains an appreciable quantity of oxide, enough apparently to account for its acting as a mercurial; and the same fact has been rendered probable of the pill and powders of mercury. Besides it is well known, that metallic mercury has been often taken in large quantity accidentally or for medicinal purposes, and retained long in the body, without inducing its specific effects; and the same negative results were recently obtained by Dr Wright, when mercury was given for a length of time to animals in a state of fine division, as prepared by decomposing calomel with protochloride of tin, and carefully freed from oxide by washing it with acetic acid before administration. The

occasional occurrence of mercurial action in those who have swallowed mercury in its fluid state,—a rare and even doubtful incident,—may be accounted for by reference to some farther experiments by Dr Wright, showing that finely divided mercury taken in frequent small doses will sometimes exert its specific action, if oxygen gas be introduced into the alimentary canal along with it.

Leaving the metal itself out of view, and taking all its preparations into account, it appears that mercury is physiologically a corrosive, an irritant, errhine, cathartic, and astringent,—a stimulant, diuretic, diaphoretic, cholagogue, and emmenagogue,—and an exciter of that peculiar state of the constitution denominated mercurial action, of which salivation is one of the chief local signs. Therapeutically it is an antiphlogistic, alterative, sedative, or contro-stimulant, deobstruent, antisyphilitic, and anthelmintic, as well as a corrector of various other special morbid states of the system.

The CORROSIVE action of mercury is confined to those of its compounds which act chemically on the animal textures. The nature of this chemical action is not yet thoroughly understood. In some instances, mutual decomposition of the mercurial compound and animal substance seems to ensue; but in others the mercurial compound simply unites with the proximate animal principles of the decomposed texture. The result however is disorganization of the part acted on, and consequent sloughing. The corrosive action of mercurials is chiefly known as exerted on the mucous membrane of the alimentary canal in cases of poisoning. It is but feebly exerted on the external surface of the body, being resisted by the dense texture of the cuticle; and therefore it has been little resorted to in the practice of medicine or surgery. The mercurial corrosives are energetic poisons, a few grains having frequently been sufficient to prove fatal. Their effects as mere corrosives however are generally complicated with their constitutional action as mercurials; and the latter action is the most common cause of death. Corrosive sublimate and bicyanide of mercury among the officinal preparations of the British Pharmacopœias, and also the nitrates employed for preparing other compounds, are all known to be powerfully corrosive; and it is probable that the acetate and persulphate partake of the same property. The antidotes for the mercurial corrosives are white of egg alone, or still better this followed by infusion of galls or catechu (Dr S. Wright),—also milk, and such other animal fluids as promptly decompose them, or unite with them to form insoluble compounds.

The IRRITANT action of mercurials is manifested in the production of redness and increased discharge, frequently inflammation, and sometimes ulceration, passing on occasionally to sloughing and gangrene. There are few preparations which do not possess more or less of this property,—even those where mercury is commonly conceived to exist in the metallic state being not altogether without some tendency to cause irritation. The most active irritants how-

ever are the soluble compounds, such as all the corrosive salts just mentioned. Next to these in activity are the binoxide and subsulphate, with probably also the white precipitate, the iodide, and biniodide. Calomel and the protoxide come next, and are peculiarly distinguished among the compounds of mercury by their tendency to cause heightened vascularity and increased secretion where they are applied, but without this irritation tending in general to become excessive. The mercurial pill, liniment, plaster, and ointment are feebly irritant, and so are the powders obtained by extinguishing mercury through means of trituration with chalk and magnesia. The bisulphuret is probably destitute altogether of irritant action so long as it is not decomposed by heat. The local irritating properties of mercurials constitute some of them poisons; and among these are a few, which are active irritants, though not corrosive, such as the peroxide, subsulphate, and probably the iodides and white precipitate. It is doubtful whether calomel ought to be considered as coming under the same category. But it is usually included; and in some constitutions it is well known to act as a powerful irritant, occasioning hypercatharsis when swallowed, as well as other symptoms of enteric inflammation.

The irritant action of mercurials is the source of various subordinate actions, which have been turned to account in the practice of medicine. To this property are owing their effects as astringents, errhines, and cathartics. The soluble salts and also the peroxide, subsulphate, and white precipitate are ASTRINGENT by virtue of their chemical action or irritant power. Corrosive sublimate and the peroxide are sometimes applied externally for their astringent effect. All these preparations likewise act energetically on the lining membrane of the nostrils, causing profuse discharge, sneezing, and vascularity; and are therefore ERRHINES. The subsulphate has commonly been preferred to other mercurials as an errhine. I do not know a more energetic drug of this description than the sublimed vapour of the biniodide of mercury. It is probable that all the officinal preparations of mercury are more or less CATHARTIC, with the exception of the bisulphuret. The soluble salts are violently cathartic, the insoluble compounds mildly or briskly according to circumstances. Of all the preparations none is so convenient for obtaining a cathartic effect as calomel; which, according to its dose and the remedies of corresponding qualities given along with it, may be rendered either a mild alterative laxative or a powerful hydragogue. The cathartic action of calomel and other mercurials is uncertain unless other cathartics be united with them. Their action upon the bowels is believed to be always attended with an increased discharge of bile from the gall-bladder. The liability of the bowels to be acted on by mercurials must be attended to and counteracted, when they are given for other purposes with which that action is incompatible. The usual method of accomplishing this object is by combining a little opium with them. In many

people, their action on the bowels is manifested by severe griping without purging. This inconvenience is best counteracted by opium where purging is inexpedient, and by mild laxatives where it is desirable that the bowels be moved. The special applications of mercurial cathartics are so endless that it would be out of place to particularize them here. They are employed in general whenever it is desirable to increase the effect of other cathartics, especially those of the hydragogue class, to promote the biliary secretion at the same time, to restore the bowels gradually from a state of habitual constipation, to improve digestion, and to combine with their cathartic effect that obscure variety of action which has been termed alterative. Serviceable however, as mercurial cathartics undoubtedly are for all these objects, there can be no doubt that they are used by many too exclusively and extensively, and that other cathartics will often attain the same ends equally well.

The most important of the physiological effects of mercury is that constitutional state which has been variously denominated mercurial action, mercurial erethysm, or most simply and conveniently, MERCURIALISM. This is a peculiar state of excitement of the constitution, partaking of the febrile character, and accompanied by a variety of local symptoms, which, in their characteristic state of combination, no other substance can excite. Mercurialism may be induced quickly by a single dose, or slowly by repeated small doses. In the former case it is usually violent in degree; in the latter it commences in general mildly, and may for the most part be regulated as to degree, at the will of the practitioner. The symptoms in ordinary circumstances are in the first instance some excitement of the circulation, with other characters of a mild febricula,—then a peculiar fetor of the breath, with a coppery taste, and redness of the gums where they touch the teeth,—by and bye an increased flow of saliva, with more redness, some swelling, and a spongy appearance of the gums, some fulness and tenderness of the external fauces, and more acceleration of the pulse,—and subsequently superficial ulceration of the gums, inside of the cheeks, and often the throat also. In mild cases these local symptoms continue for a few days, and then gradually recede. None of them is invariable except fetor of the breath and redness of the gums; without which therefore it is impossible to feel assured that mercurial action is present. The effects of mercurial action on the mouth may be confined with careful management to fetor, redness of the gums, and slight salivation, and may be maintained at that degree for a long time. The accomplishment of this object is probably sufficient for attaining any curative effect which mercurial action can produce. The phenomena of mercurialism however are often much more violent. Sometimes it commences with great disturbance of the circulation, high fever, irregular action of the heart, and occasionally nervous symptoms resembling hysteria. In that case the local affections commonly set in with unusual severity. The sali-

vary glands, the cheeks, throat, tongue and gums become much swelled and painful, often ulcerate deeply and extensively, and even pass on to sloughing and gangrene, with strong fetor and profuse salivation. The same local affections also sometimes occur without any unusual violence of the precursory excitement of the circulation.

In some instances a totally different set of symptoms are produced by the constitutional action of mercury. Instead of being excited, the pulse is rather slow; the mouth may be little acted on, or even not at all; and the most prominent affection is constant tremor and convulsive starting of the muscles of the extremities, jaw, and tongue, so as to deprive the patient of the power of regulating voluntary motion, and consequently to prevent him from walking, working, or even feeding himself. This state, which is termed mercurial palsy or mercurial trembling, is chiefly observed in workmen who habitually handle mercury or breathe its fumes, and is very rarely occasioned by its medicinal use.

Mercurial action may be occasioned by a single large dose of most of its preparations. In such circumstances it is commonly violent. Its most severe form is that which follows the administration of poisonous doses of corrosive sublimate and other soluble salts. In such cases the local affections in or near the mouth often prove the immediate cause of death. Mercurial action may also be induced by frequent small doses of its preparations; and then, if the doses be properly managed and no peculiarity of constitution interfere, the effects are mild and easily controlled. But in certain unknown constitutional states mercury cannot be given in any form or manner without occasioning violent general, as well as local, disturbance, which may prove fatal.—The constitutional effects of mercury sometimes do not show themselves till the administration of it has been abandoned for some considerable time. In some rare instances too, after it has entirely ceased, mercurial action breaks out anew without the mercury having been resumed.

Under the co-operation of collateral circumstances mercurialism is often attended with various other phenomena besides its proper symptoms hitherto mentioned. Thus exposure to cold about the time of its commencement is apt to occasion internal inflammations, especially of the serous membranes. The same cause sometimes occasions febrile eczema, a peculiar vesicular eruptive disease; and other chronic eruptions of the impetiginous and scaly kind are apt also to arise under circumstances not yet exactly determined. The presence of the strumous diathesis is apt to lead to obstinate glandular enlargements and suppuration, to ulcers of the integuments, and to diseases of the bones. The concurrence of syphilis is also thought by some to have the same effects; and in no circumstance does mercury so often give rise to troublesome and severe diseases of the glands, bones, and skin, as where it is administered in a strumous constitution tainted also by the venereal poison

From recent inquiries by Dr Samuel Wright (Thesis, *ut supra*), it would appear, that under the specific action of mercury the blood is materially changed in its constitution, that it is rendered more watery, more prone to putrefaction, less charged with albumen, colouring globules, and fibrin, and loaded with a very fetid fatty matter. Its average composition from three trials made on men under salivation was water 827.6, fibrin 2.4, albumen 57.2, colouring matter 94.5, oil 4.1, fetid fat soluble in ether 9.5, salts 3.7, loss 5.1. Mr Aymes has since arrived at different results. For he has found the fibrin, fat, albumen and salts only a little diminished, but the colouring matter so much increased as to occasion a true inspissation of the blood. Doubts exist whether mercury can be detected in the body. Very contradictory statements have gone forth on this question. The subject cannot be properly discussed here. In addition to the facts on both sides collected in my Treatise on Poisons, p. 363, it may be added that Dr Wright could never detect it in the blood unless directly introduced into the blood-vessels. Such negative facts however are not sufficient evidence that mercurials do not act through absorption. For the same author found that a dog was salivated in four days by $1\frac{1}{6}$ grain of protoxide of mercury introduced in divided doses into the blood; and that this quantity was too minute to be detected by analysis.

All the officinal preparations of mercury are in one way or another capable of inducing mercurial action. The probability seems to be however, that the metal and its sulphuret must undergo oxidation before entering the animal body, in order to produce this effect. The constitutional action of mercury is excited by its preparations in whatever manner they are applied to the body. When they are swallowed, or used in the way of injection, or rubbed into the skin, or placed on an abraded surface, or when their vapours are brought in contact with the integuments, or inhaled into the lungs,—in all these ways mercurialism may be equally induced. The inhalation of mercurial vapour is the most prompt medicinal mode of bringing it on; and next in point of promptitude is the administration of the more active compounds by the mouth.

It is often necessary to prevent or mitigate the force of mercurial action. Where severe mercurialism is dreaded, advantage is frequently obtained from administering a brisk saline purgative on the mercury being discontinued, maintaining a steady, moderately warm atmospheric temperature, and keeping the throat and neck cool. When it has already broken out the same means should be resorted to, along with the occasional employment of the warm-bath, and the application of leeches behind the jaws if the swelling and pain be considerable. Some have thought that nauseating doses of tartar-emetic act as an antidote to mercurial action; and others have proposed ten-grain doses of acetate of lead three or

four times a-day with the same view (Daniell). I have several times tried both plans, and with apparent utility. For relieving the uneasy sensations in the mouth, the best application in the early stage is borax in the form of honey or simple solution. After a time, especially when ulceration has taken place, strong astringent lotions and gargles, prepared with alum, catechu, and cinchona-bark, become more serviceable; charcoal suspended in water is also a favourite application with some; but nothing has seemed to me to give so much relief at the time, or so to accelerate recovery, as a weak lotion of chloride of lime, consisting of one part of chloride in one hundred or one hundred and fifty parts of water.

The constitutional action of mercury is the foundation of several of its most important general Therapeutic actions. Among these may be particularly mentioned its actions as an antiphlogistic, antisyphilitic, and deobstruent.

The Antiphlogistic properties of mercury are manifested in the cure of continued and remittent fevers. In some severe forms of typhus, where the head is unusually affected, in severe remittents of the typhoid character, and in yellow fever, mercury in the form of calomel is given by many freely as a febrifuge, and seems often serviceable. Its curative effects have been commonly observed to be accompanied with the usual symptoms of its constitutional operation, and among the rest with the affection of the mouth. Hence the inference has been drawn, that this physiological action is indispensable to the febrifuge effect of mercury, and that the mode in which it operates is through means of the incompatibility of two simultaneous constitutional actions in the animal system. The antiphlogistic properties of mercury are likewise illustrated by its effects in arresting acute internal inflammations. Its operation is more unequivocal here than in general fevers. It is often employed with advantage in pneumonia, pleurisy, peritonitis, hepatitis, cynanche laryngea, and iritis. The effect on the disease is never well-marked until some degree of mercurial action has begun to show itself. More advantage is observed to accrue from this mode of treatment where the inflammation has subsisted for some time and the force of reaction has been mitigated by blood-letting, than in recent cases where the circulation remains in a state of unsubdued excitement. A steady gentle perspiration commonly attends the therapeutic effect. Although in general no good is attained till mercurial action be developed, there is on the other hand no advantage in that action being rendered intense. On the contrary, the disease is as thoroughly broken, and the patient's strength materially saved, when the evidence of the constitution being affected is confined to fetor of the breath, tenderness of the gums, and possibly a very slight flow of saliva. The moment therefore that mercurial fetor is detected, active measures should be taken to moderate the approaching mercurialism. The usual mode of administering mercury as an antiphlogistic in acute inflammations is to

give two or three grains of calomel with a little opium three, four, or six times a day, or even more frequently, according to the urgency of the case. In general fevers it is usually given alone. In both circumstances mercurial inunction is occasionally conjoined with the internal use of calomel.—Doubts have been entertained by some of the reality of the power of mercurial action to arrest fever and inflammation; and they maintain that the cure is a coincidence rather than a consequence. There is no mistaking however the reality of the effect, where it is found, as often happens, that the first signs of amendment correspond with the earliest symptoms of mercurialism.

Although the general antiphlogistic properties of mercury seem to be associated with its constitutional operation, there is one special antiphlogistic effect which seems wholly independent,—that namely, which is manifested from the administration of large doses of calomel in dysentery and other enteric inflammations. The phenomena here adverted to have been usually referred to what is called the sedative action of mercury, under which head they will be mentioned more particularly.

The ANTISYPHILITIC virtues of the preparations of this metal are connected, like its antiphlogistic properties, with its constitutional action. The therapeutic effect is never unequivocally manifested until some affection of the mouth is induced. The curative result is believed to be owing to the incompatibility of two actions, the mercurial and the venereal; either of which must yield its place in the constitution to the other. For some years, especially in Britain, a keen controversy has prevailed respecting the reality of the therapeutic virtues long ascribed to mercurialism in the venereal disease. It would be out of place to enter into the merits of this question here. The general result of the inquiry is all which is admissible. On the whole the conclusions, to which an impartial observer will generally be led, seem to be: That many cases of unequivocal syphilis, both primary and secondary, may be cured radically, without mercury, by simple local treatment and careful regimen: That most primary cases, which do not thus improve in a few days, are more speedily cured with mercury than without it: That secondary symptoms, arising where mercury has not been used, are best treated with it: That secondary syphilis, after a sufficient course of mercury in the primary stage, or continuing in spite of such a course in the secondary stage, is always best treated without any more of it: That violent local inflammation in the primary form contraindicates mercury for the time: That the strumous constitution, concurring with the primary or secondary form, but especially the latter, is also for the most part a strong contraindication: That violent or long continued mercurial action has no advantage as an antidote for the venereal poison over a mild mercurialism maintained for two or three weeks: And that the worst of all possible ways of treating obstinate secondary cases is by reite-

rated severe courses of mercury, after the manner which was fashionable till about twenty-five years ago.—Any of the preparations of mercury may be used for obtaining its antisyphilitic operation. They should be given for the most part in moderate doses twice a day so as to bring on mercurialism gradually.

The DEOBSTRUENT action of mercurials, or that property which consists in the removal of glandular swelling, morbid deposits, and other organic alterations of structure, is probably subordinate to the influence they are known to possess as stimulants. At all events it is often exerted where mercurial action is not induced and not aimed at. But at the same time the most unequivocal examples of their deobstruent virtues occur where the curative and the constitutional effects of the remedy seem to be closely connected. The special applications of mercury which come under the present head are numerous. In congestive enlargement of the liver, especially commencing in hot climates, the most approved mode of reducing the organ to its natural size and the healthy exercise of its functions is by a mild continuous, or repeated, mercurialism. The same treatment occasionally, though by no means so frequently, answers well in other chronic diseases of the liver, among which may be particularly specified jaundice. A constitutional course of mercury sometimes puts an end to obstruction of the bowels. In some forms of palsy its effects are also at times well-marked. Even hemiplegia is sometimes thus removed, but more frequently partial palsy depending on interruption to the functions of particular nerves, especially the nerves of the face. Equally distinct advantage is likewise frequently remarked in the removal of effusions consequent upon inflammation, as in recent fibrinous effusions into the aqueous humour from iritis. In all these, as well as in other instances, of deobstruent action, it is not unusual to find the first signs of improvement concurring precisely with the first outbreak of mercurialism. It is difficult therefore to suppose that the two phenomena are not in some way related; and it seems probable that the therapeutic result is effected through the excitement of a stimulant action upon the absorbent system.

Many of the therapeutic properties of mercury are plainly subordinate to its action as a STIMULANT. It acts as a stimulus of the circulation, of absorption, and of secretion. Its stimulant effects over the circulation are manifested, as already mentioned, during the excitement of mercurialism; and it is doubtful whether the circulating system is ever similarly affected except in connection with that constitutional state. The influence of mercury however in exciting absorption is evidently often independent of its constitutional action,—being evinced for example in the removal of glandular obstructions under the administration of doses which do not appreciably affect the mouth. In like manner it unquestionably possesses the property of stimulating various secreting organs,—of

rousing the liver to increased discharge of bile, the kidneys to increased discharge of urine, the skin to increased perspiration, and probably the uterine vessels to the secretion of the menstrual fluid, —without necessarily inducing its peculiar constitutional effects. Nevertheless it is admitted that several of the stimulant effects now mentioned are induced with more certainty and energy where mercurial action is at the same time brought on.—Increased secretion is always established with more certainty by mercury when its operation is aided by some other remedy which acts peculiarly on the secreting organ whose function the practitioner desires to influence. As a diuretic or diaphoretic, at least, it is uncertain in effect, and therefore not often resorted to, unless in conjunction with such remedies as digitalis or squill in the one case, and opium in the other. Its emmenagogue virtues, though currently credited, are obscure, and not to be depended on. A collateral action, however, its power of inducing miscarriage, is undeniable. But this effect ensues only in connexion with mercurialism, and probably too, only where this is so violent as to occasion either severe agitation of the system or great exhaustion. At all events mild mercurialism is often induced in pregnant females, without miscarriage being caused.

Under the head of the stimulant effects of mercury may probably be comprised its ALTERATIVE action. This is the most obscure of all its recognized properties. When its preparations are given in small doses or at distant intervals, although no obvious effect may be occasioned by each singly, there is at length produced in various cachectic states of the body an alteration of the habit of the patient from worse to better. It is not necessary for this result that even the slightest mercurialism be induced, although a trivial action on the mouth does no harm. Nor is it necessary that purging be brought on, though in general the stools do become more frequent. The only physiological phenomena obviously attending the alteration of habit are improvement of appetite, cleaning of the tongue, a more healthy condition of the discharges from the bowels, and a more perspirable state of the skin. During this condition of the system it has been observed that various chronic diseases often disappear, such as depraved digestion, irregular action of the bowels, numerous chronic eruptions, diseased mesenteric glands, and glandular enlargements of the external absorbent system. The alterative properties of mercury are familiarly spoken of by many as constituting a peculiar action. But its alterative action is in all probability nothing more than a convenient term for denoting a concurrence of various familiar effects,—being made up of a stimulant operation upon the secretion of the alimentary mucous membrane, on that of the liver, and on absorption. The stimulant effects of mercury on absorption and secretion, together with its complex results as an alterative, are best secured by the administration of small doses of its mildest preparations, such as a blue pill, or

two grains of calomel, every other evening or once in twenty-four hours at most.

Among the properties of mercurials it has been usual of late to admit a SEDATIVE action. In one sense a sedative action may be said to have been long known; for this term may be used as another name for the antiphlogistic effects developed during the existence of mercurialism. But the property now adverted to is possessed independently alike of mercurialism and of all the other known actions of mercury. It has been hitherto noticed only in relation to an inflammatory state of the intestinal mucous membrane. It has no existence, so far as is yet known, in the healthy state; and hence it may be more correctly viewed as a Controstimulant than as a sedative effect. Mercury has no general controstimulant influence over the circulation or nervous system, independent of the existence of mercurialism. But the experience of British practitioners in India, confirmed by occasional facts observed at home, leave no doubt that it possesses a local controstimulant action,—that in dysentery and other enteric inflammations, large doses of calomel, such as twenty grains or more, instead of adding to the local irritation, as might be expected from the well-known effects of that drug on the healthy bowels in less doses, have a tendency to soothe pain, allay spasm, abate redness, and lessen excessive secretion; and all these singular phenomena are entirely unconnected with mercurialism. They have not yet been observed in respect to any other preparation but calomel. The usual practice in the East, for attaining its sedative action, is to administer several scruple doses in the course of the day.

The preparations of mercury are also commonly considered to be ANTHELMINTIC in their action. Some of its compounds, especially calomel, are acknowledged to possess the power of expelling intestinal worms. It may be doubted whether this power exists independently of their cathartic properties. Calomel however forms a part of many anthelmintic purgative prescriptions, and is often serviceable against ascarides and the round worm, especially in the cases of children.

Metallic mercury itself is sometimes used on account of its MECHANICAL properties. Obstruction of the intestines is occasionally removed by the administration of a pound or two of mercury; and it is consequently sometimes resorted to when all other remedies have failed.

The preparations made from mercury by mechanical means only, and therefore commonly thought to contain it in the metallic state, are the following: *Pilula hydrargyri*, E. L. D., gr. v. ad gr. x.—*Hydrargyrum cum creta*, E. L. D., gr. v. ad gr. xx.—*Hydrargyrum cum magnesia*, D., gr. v. ad gr. xx.—For external use, *Hydrargyri unguentum*, E. L. D.—*Hydrargyri unguentum mitius*, L. D.—*Hydrargyri linimentum*, L.—*Hydrargyri emplastrum*, E. L.—*Emplastrum hydrargyri et ammoniaci*, E. L. D.

HYDRARGYRI ACETAS, *D.* *Acetate of protoxide of mercury.*

PROCESS, *Dub.* Take of
Purified mercury, and
Acetate of potash, of each nine parts;
Diluted nitric acid, nine parts;
Boiling distilled water, one hundred parts;
Distilled vinegar, a sufficiency;
Add the acid to the mercury; and after effervescence ceases, digest the mixture so as to dissolve the metal. Dissolve the acetate in the water, and acidulate the solution with the vinegar. To this while boiling hot add the solution of mercury in nitric acid, and filter through a double cloth quickly. Set the filtered fluid aside to crystallize, wash the crystals with cold distilled water, and dry them on paper with a gentle heat. Glass vessels must be used throughout this process.

FOR. NAMES.—*Fren.* Proto-acetate de mercure.—*Ital.* Acetato di protossido di mercurio.—*Ger.* Essigsaures queeksilberoxydul.

IT has been known for nearly two centuries that acetic acid unites with mercury; but the true nature of the acetate of its protoxide was first ascertained so recently as 1809 by Strohmeyer (Geiger). About the middle of last century the French government purchased the secret of a nostrum for the venereal disease, called Keyser's pills, which was said to have the property of eradicating the syphilitic virus without exciting salivation. This was probably a mixture of the acetates of protoxide and peroxide of mercury. The Colleges of this country, in adopting Keyser's preparation, endeavoured to improve it by rendering it a uniform salt of the protoxide of mercury. The acetate however has no advantages over other more familiar compounds of this metal, while it is subject to the inconvenience of being easily decomposed. On these accounts, and likewise because it has now been for many years in the Pharmacopœias without coming into use in British practice, it has been expunged from the last editions of the Edinburgh Pharmacopœia. It is now retained by the Dublin College only.

Chemical History.—The acetate of protoxide of mercury may be obtained by dissolving the protoxide or carbonate in warm acetic acid and cooling the solution. But it is more frequently prepared in the way of double decomposition, by mixing together solutions of protonitrate of mercury and acetate of potash or soda. It is a matter of some nicety to form a pure nitrate of the protoxide of mercury, free of any peroxide. If the nitric aid be made to act briskly by being used in excess and with the aid of heat, little else than pernitrate is formed. But if the metal be in excess and the action be allowed to go on at atmospheric temperatures, or with the aid of a very gentle heat after the effervescence has begun to subside, a large proportion of the mercury is converted into protoxide. A portion however is always dissolved in the form of peroxide, even when the solution is allowed to go on slowly, without heat, and in an acid considerably more diluted than in the Dublin formula. The most certain way of obtaining a pure solution of protonitrate of mercury, is to keep an excess of mercury in the acid, to allow the action to take place slowly, and to separate occasionally the crystals which are deposited. These consist entirely of the salt of

the protoxide till near the close of the process, when a little nitrate of the peroxide is crystallized along with the former. The salt thus prepared is then to be dissolved without heat in ten parts of water acidulated with about a sixtieth of its weight of nitric acid. If the water be not acidulated, the nitrate of mercury is decomposed and resolved into a soluble salt with an excess of acid and an insoluble basic salt of a grayish-white colour. If heat be employed in effecting the solution, a part of the salt is apt to pass to the state of pernitrate.—The acetate of soda is preferable to the acetate of potash for effecting the decomposition of the nitrate of mercury; for, not being deliquescent, like the acetate of potash, the due proportion of the alkaline and mercurial salts is more easily secured. When the solution of nitrate of mercury is poured into a hot solution of acetate of potash or soda, no change ensues at first; but as the mixture cools, beautiful delicate pearly scales are deposited, which are the acetate of protoxide of mercury. These crystals are prone to decomposition under exposure to heat or light; and therefore, after being duly washed with cold water, they must be dried in a dark place with a gentle heat only.

Acetate of protoxide of mercury forms thin foliaceous crystals, of a pearly lustre, and colourless. It has a strong unpleasant metallic taste. It is decomposed and becomes gradually black under exposure to light. It is also decomposed by a moderate heat, and a higher temperature dispels it entirely. It is very sparingly soluble in cold water; and boiling water partly dissolves and partly decomposes it—a portion being converted into acetate of the peroxide and dissolved along with the acetate of the protoxide, while some metallic mercury is disengaged. Alcohol does not act upon the salt without heat; and boiling alcohol decomposes it. Its hot aqueous solution crystallizes regularly, and free of any peroxide existing in solution along with it, because the acetate of that oxide is much more soluble in cold water. Its solution is precipitated black by all the alkalies, while that of the nitrate of the peroxide is precipitated yellow by potash and soda. It probably consists of one equivalent of each constituent $(HgO+\bar{A})$, and consequently 210 parts of oxide and 51.48 of acid.

Actions and Uses.—There is no ground whatever for the statement which accompanied the introduction of acetate of mercury into regular practice, that it does not produce salivation. In this respect it acts precisely like other mercurials; and, being soluble, it is probably a preparation of considerable activity. Little positive information however is possessed as to its effects. It is usually given in the form of pill.

Its officinal form is the pure salt only, of which the dose is gr. i. ad gr. v.

HYDRARGYRI AMMONIO-CHLORIDUM, *L.* See *Hydrargyri Precipitatum album.*

HYDRARGYRI BICHLORIDUM, *L.* CORROSIVUS SUBLIMATUS, *E.* HYDRARGYRI MURIAS CORROSIVUM, *D.* *Bichloride of Mercury. Corrosive sublimate.*

TESTS, *Edin.* It sublimes without any residuum; and its powder is entirely and easily soluble in sulphuric ether.

TESTS, *Lond.* It is liquefied and sublimed by heat: entirely soluble in water and sulphuric ether; and its solution yields to potash or lime-water a red precipitate, which becomes yellow when the test is added to saturation: the precipitate when heated emits oxygen and forms globules of mercury.

PROCESS, *Edin.* Take of
Mercury, four ounces;
Sulphuric acid (commercial), two fluidounces and three fluidrachms;
Nitric acid, half a fluidounce;
Muriate of soda, three ounces.
Mix the acids; dissolve the mercury in them with the aid of a moderate heat; raise the heat so as to obtain a dry salt; triturate this well with the muriate of soda; sublime in a proper apparatus.

PROCESS, *Lond.* Take of
Mercury, two pounds;
Sulphuric acid, three pounds;
Chloride of sodium, a pound and a half.
Boil the mercury with the acid in a proper vessel till a dry bipersulphate of mercury remain; triturate this when it cools with the chloride of sodium in an earthenware mortar; and sublime with a gradually raised heat.

PROCESS, *Dub.* Take of
Persulphate of mercury, five parts;
Dried muriate of soda, two parts.
Triturate them together to a very fine powder in an earthen-ware mortar: with a gradually-raised heat sublime the corrosive muriate of mercury from a proper vessel into a receiver.

LIQUOR HYDRARGYRI BICHLORIDI, L.

PROCESS, *Lond.* Take of
Bichloride of mercury, and
Hydrochlorate of ammonia, of each ten grains;
Distilled water, a pint.
Dissolve the salts in the water.

FOR. NAMES. – *Fren.* Deutochlorure de mercure; Sublimé corrosif.—*Ital.* Deutocloruro di mercurio. Sublimato corrosivo.—*Ger.* Doppelt-chlorquecksilber; Aetzender sublimat.—*Russ.* Dvuchloristaia rtut; Surema.—*Arab.* Soleimanie.

CORROSIVE SUBLIMATE (Bichloride of mercury; Oxymuriate of mercury; Corrosive muriate of mercury) seems to have been known to the Chinese from a remote period; and the preparation of it was described by Geber in the eighth century (Geiger).

Chemical History.—It may be variously prepared, both by sublimation and in the moist way by crystallization. It is obtained in the latter mode by adding muriatic acid to a hot concentrated solution of pernitrate of mercury so long as a precipitate forms, and then boiling the whole with as much additional muriatic acid as was used in the first instance,—upon which the precipitate is redissolved, and corrosive sublimate crystallizes on cooling. This process however is not economical, and the manufacturer therefore prefers the method by sublimation. One process consists in heating ten parts of mercury with eight of muriate of soda, six of black oxide of manganese, and eleven of sulphuric acid diluted with its weight of water, until no more liquid condenses in the upper part of the vessel,—and then raising the temperature sufficiently to sublime the corrosive sublimate which forms. In this process two equivalents of chlorine are disengaged by the action of the sulphuric acid on the salt and oxide of manganese and the chlorine in its nascent state coming in contact with the mercury, it unites with

one equivalent of the metal, so that bichloride of mercury is at once formed. A patent has been taken for preparing corrosive sublimate by heating mercury in a current of chlorine gas (Dr A. T. Thomson). But the product is not uniform, a proportion of calomel being always formed, amounting sometimes to ten per cent (Maclagan). The process most generally followed in this country is the one adopted by the three British Colleges; which consists in obtaining bisulphate of peroxide of mercury according to the method explained under the article *Hydrargyri persulphas*, and then heating this salt along with chloride of sodium. For every equivalent of bisulphate of mercury two equivalents of chloride of sodium must undergo decomposition (HgO^2+2SO^3) and ($2NaCl$); because one equivalent of the mercurial salt yields two equivalents of oxygen to oxidate the sodium, as well as two equivalents of sulphuric acid to combine with the soda thus generated. Two equivalents of chlorine are in consequence set free, which, meeting with one equivalent of liberated mercury, unite with it to constitute one equivalent of bichloride.—In making corrosive sublimate by the process of sublimation, great care must be taken to avoid the fumes, which, even in small quantity, are highly poisonous when inhaled.

Corrosive sublimate is usually sold in the form of a white powder, or of a white, translucent, compact, crystalline mass, fibrous in texture, very brittle, about 5.2 in density, and possessing an intense, persistent, styptic, metallic, acrid taste. It readily crystallizes in quadrangular prisms terminated by two converging planes. It is permanent in the air. Heat fuses it and then sublimes it unaltered. Water, alcohol, and ether dissolve it. Its solubility in water is variously stated between one part in twenty of temperate and three of boiling water (Thenard), and one in eleven of the former (Orfila), and two of the latter (Geiger). Its solubility is much increased by the coexistence of alkaline muriates in the solution, and especially by muriate of ammonia. It is much more soluble in alcohol and ether than in water, alcohol dissolving one-half and ether a third of its weight; and hence it may be removed in a great measure from an aqueous solution by agitation with ether. Sulphuric acid has no action on it; and nitric and muriatic acids, even aided by heat, merely dissolve it. The caustic alkaline solutions disengage from it the yellow peroxide of mercury; but ammonia unites with it to form a white double salt. When heated with the fixed alkalis or their carbonates, an alkaline chloride is left, and metallic mercury sublimed. When exposed to the light in contact with organic substances, it is decomposed, and calomel or mercury produced. Its solution is characteristically acted on by various reagents. Caustic potash, soda, or lime disengages the yellow peroxide; ammonia throws down a white chloride of mercury and ammonia; alkaline carbonates separate a brick-red carbonate of mercury; hydriodate of potash occasions a yellow precipitate, gradually becoming the carmine-red biniodide of mercury;

solution of protochloride of tin first abstracts part of its chlorine, so as to throw down calomel, and in larger quantity it removes the rest of the chlorine also, so that metallic mercury separates in a state of fine division; sulphuretted-hydrogen produces a grayish precipitate, passing quickly through yellow to black, as the transmission of the gas continues, and at length the bisulphuret of mercury is obtained in the form of a black powder. Metallic mercury agitated with the solution converts the salt into calomel. Copper and many other metals displace the mercury, taking its place in the solution and depositing it in the metallic state. Silver and gold aided by galvanic action also reduce the salt to the metallic state, and are at the same time amalgamated. Hence a mixture of iron-filings and gold dust decomposes it with rapidity, and has been recommended as an antidote in poisoning by it (Buckler).

The best medico-legal tests for corrosive sublimate in the solid state are the action of an alkaline carbonate aided by heat, and that of a caustic alkaline solution; and for the solution the best tests are solution of potash, iodide of potassium, protochloride of tin, and sulphuretted-hydrogen. In organic mixtures undecomposed corrosive sublimate may first be sought for with ether; and failing this method, the mercurial compound in either fluid or solid matter is to be converted into mercury by protochloride of tin, the organic matter dissolved by boiling the whole with solution of potash, and the detached mercury washed, collected, and sublimed.

Most vegetable juices and infusions decompose the solution of corrosive sublimate either immediately or slowly, above all when the mixture is exposed to the direct rays of the sun. In this action sometimes calomel is formed, sometimes mercury, and sometimes a compound of chlorine, mercury, and one or other of the vegetable principles in the fluid. Animal fluids decompose the solution more promptly, and an insoluble substance falls down, which, though considered by some to be a protochloride of mercury and animal principles, is more probably a compound of the animal principles with the bichloride itself. Solutions of albumen and casein are the most powerful agents of this class. The compound formed with albumen consists of 6.45 per cent of bichloride of mercury and 93.55 of albumen (Lassaigne). All the soft animal solids exert a similar action in a greater or less degree; and vegetable gluten seems to act in the same manner. Hence white of egg, milk, and gluten of wheat, are considered antidotes in poisoning with corrosive sublimate.—This salt consists of one equivalent of metal and two of chlorine ($HgCl^2$), and consequently 202 parts of the former and 70.84 of the latter.

Adulterations.—According to my experience corrosive sublimate is little subject to adulteration. It is said to be sometimes adulterated with calomel or with sal-ammoniac. Either of these will be detected according to the Edinburgh formula of tests, by agitating the salt with sulphuric ether, five or six parts of which will readily

dissolve it all if pure. Sublimation, the only other character added by the Edinburgh College, will detect fixed impurities; but I have never met with any such admixture in the corrosive sublimate of the shops. The London College, in addition to these characters, has stated others, which tend merely to prove its nature, not to discover impurities.

Actions and Uses.—Corrosive sublimate possesses almost all the actions which have been described under the article *Hydrargyrum* as characterizing the different preparations of mercury. In particular it is a powerful irritant and corrosive, adequate to occasion death in the dose of a few grains. It operates in such circumstances sometimes through its corrosive effects, sometimes through a depressing influence on the brain and nervous system, sometimes through the induction of excessive mercurialism. Its best antidotes are white of egg, milk, and particularly the former of these followed immediately by infusion of galls or catechu (Wright). M. Mialhe has recently recommended the hydrated protosulphuret of iron for this purpose. Corrosive sublimate is converted in the living body into calomel.——It is comparatively little used in medical practice in this country. It is nevertheless an excellent mercurial and alterative in small doses, and has been much employed as such abroad, especially in venereal affections, cutaneous eruptions, and chronic diseases of the viscera. It was first strongly recommended by Van Swieten. It may be given in the form of pill made simply with bread-crumb, or in a state of solution in water alone, or in some simple aromatic water. Although sometimes employed externally as a corrosive, it is not generally approved of, because it is apt to act constitutionally. It is a good deal used as a stimulant collyrium in strumous ophthalmia.

The doses of its officinal preparations are, *Hydrargyri bichloridum*, L.—*Hydrargyri murias corrosivum*, D.—*Corrosivus sublimatus*, E., gr. $\frac{1}{16}$ ad gr. $\frac{1}{6}$.—*Liquor hydrargyri bichloridi*, L. fl. dr. i. ad. fl. dr. iii.

HYDRARGYRI BICYANIDUM, *L.* HYDRARGYRI CYANURETUM, *D.* *Bicyanide of mercury.*

TESTS, *Lond.* Translucent; entirely soluble; hydrochloric acid disengages from the solution hydrocyanic acid, which is known by its odour, and deposites on a glass, moistened with nitrate of silver and held over it, a precipitate soluble in boiling nitric acid. Heat expels cyanogen, and converts the salt into globules of mercury.

PROCESS, *Lond. Dub.* Take of
Percyanide of iron, eight ounces (cyanide of iron, six parts, D.);
Binoxide of mercury, ten ounces (nitrico-oxide of mercury, five parts, D.);
Distilled water, four pints (forty parts, D.);
Boil them together for half an hour (with constant agitation, D.), and filter: evaporate the liquid to obtain crystals. Wash the residue repeatedly with boiling distilled water, filter the liquors, and concentrate to obtain crystals.

Note. Lond. Bicyanide of mercury may also be prepared by exactly saturating hydrocyanic acid with binoxide of mercury, the acid being obtained by the action of diluted sulphuric acid on ferrocyanide of potassium.

FOR. NAMES.—*Fren.* Cyanure de mercure; Prussiate de mercure.—*Ital.* Cianuro di mercurio; Prussiato di mercurio.—*Ger.* Doppelt-cyanquecksilber; Blausaures quecksilberoxyd.—*Russ.* Sincrodistaia rtut.

THE BICYANIDE of MERCURY is a needless encumbrance of the London and Dublin Pharmacopœias. It was introduced into the latter as the source of hydrocyanic acid; which may now be obtained more cheaply and equally well from other materials. I know not why the London College has likewise admitted it; for it is not employed in any formula of their Pharmacopœia, and the few trials hitherto made of its effects in diseases scarcely justify its introduction as a remedy. It was discovered by Scheele in the latter part of last century.

Bicyanide of mercury may be prepared either by the action of the red oxide of mercury on Prussian blue, or by dissolving the oxide in diluted hydrocyanic acid. The former method, though adopted by both Colleges, is objectionable on various grounds. In the first place the Prussian blue of commerce is so impure that it is difficult to obtain a pure bicyanide from it, unless it be first carefully purified (see *Ferri cyanuretum*); secondly, purified Prussian blue is an expensive material; and lastly, the process is uneconomical, a considerable part of the cyanogen in the Prussian blue being left behind in the form of some unascertained compound. The changes in chemical constitution, which ensue when oxide of mercury and Prussian blue are boiled together in water, have not yet been determined. The result however is that sesquioxide of iron is disengaged, and a colourless or yellowish fluid is formed, from which bicyanide of mercury crystallizes on cooling.—A much superior process in point of cheapness, facility, and purity of the product, is to prepare hydrocyanic acid from ferrocyanide of potassium (see *Acidum hydrocyanicum*), and to dissolve oxide of mercury in this acid. The solution takes place rapidly at ordinary temperatures, with the aid of brisk agitation; a colourless fluid is thus formed; and fine crystals are obtained by evaporation and cooling. Care must be taken to dilute the acid so far, that the bicyanide to be formed shall have about ten parts of water for its solution; for if water enough be not present for that purpose, the action of the acid and oxide ceases before the former is saturated. The purest crystals are obtained when a faint excess of acid is left. The London College has properly appended this process in a note.

Bicyanide of mercury forms right-angled four-sided prisms, usually white and opaque, but sometimes transparent if obtained by spontaneous evaporation. It has a disagreeable, metallic, corrosive taste. It is permanent in the air. Heat decomposes it, driving off cyanogen, and leaving mercury and a black carbonaceous matter, which seems to be isomeric with cyanogen (Johnston). Water dissolves it in the proportion of an eighth part at 60°, and much more freely at a boiling temperature. The solution is precipitated black by sulphuretted hydrogen, and hydrocyanic acid is formed. It is also decomposed by muriatic acid, hydrocyanic acid being here too disengaged, and bichloride of mercury produced.

The production of hydrocyanic acid may be proved, as the London formula states, by moistening the inside of a glass-vessel with solution of nitrate of silver and holding it over the decomposed liquid, —upon which there appears a white precipitate of cyanide of silver, soluble in boiling nitric acid. The odour of the hydrocyanic acid however is equally delicate and characteristic as a test of its presence. The solution of bicyanide of mercury is not decomposed by sulphuric or nitric acid, or by the caustic alkalis. Bicyanide of mercury is insoluble in alcohol. It consists of two equivalents or 52.78 parts of cyanogen, and one equivalent or 202 parts of mercury (Hg + 2Cy).

Actions.—Bicyanide of mercury is a powerful corrosive poison. As its physiological effects associate it more with mercurials than with the compounds of cyanogen, its medicinal properties may be inferred to resemble those of the soluble preparations of mercury. It has been very little used in medicine.

HYDRARGYRI BINOXYDUM, *L.* See *Hydrargyri Oxidum rubrum.*

HYDRARGYRI BINIODIDUM, *E. L.* *Biniodide of mercury.*

TESTS, *Edin.* Entirely vaporizable; soluble entirely in 40 parts of a concentrated solution of muriate of soda at 212°, and again deposited in fine red crystals on cooling.

TESTS, *Lond.* By the cautious application of heat it is sublimed in scales, at first yellow, but red when cooled. Partly soluble in rectified spirit, from which it crystallizes on cooling; it is alternately dissolved and precipitated by iodide of potassium and bichloride of mercury; and is entirely soluble in chloride of sodium.

PROCESS, *Edin.* Take of
Mercury, two ounces;
Iodine, two ounces and a-half;
Concentrated solution of muriate of soda, a gallon.
Triturate the iodine and mercury together, adding occasionally a little rectified spirit till a uniform red powder be obtained. Reduce the product to fine powder, and dissolve it in the solution of muriate of soda with the aid of brisk ebullition. Filter, if necessary, through calico, keeping the funnel hot; wash and dry the crystals which form on cooling.

PROCESS, *Lond.* Take of
Mercury, one ounce;
Iodine, ten drachms;
Alcohol, a sufficiency.
Triturate the iodine and mercury together, adding a little alcohol from time to time, until globules are no longer visible: dry the powder with a gentle heat, and keep it in a well closed vessel.

UNGUENTUM HYDRARGYRI BINIODIDI, L.

PROCESS, *Lond.* Take of
Biniodide of mercury, an ounce;
White-wax, two ounces;
Lard, six ounces.
Melt the wax and lard together, add the salt in very fine powder, and mix them.

FOR. NAMES.—*Fren.* Deuto iodure de mercure.—*Ital.* Deuto-ioduro de mercurio. —*Ger.* Doppelt iodquecksilber; Quecksilber-iodid.—*Russ.* Dvuch-iodistaia rtut.

THE compounds of iodine have attracted so much attention of late, that it is not amiss to supply the profession with the means of obtaining even those which have not yet been adopted generally in medical practice. The BINIODIDE OF MERCURY comes under this denomination; and it is a salt, whose properties, by reason of its composition, seem to deserve being investigated.

Chemical History.—Mercury unites with iodine in three propor-

tions, forming an iodide, a sesquiodide, and a biniodide. The biniodide may be formed either by direct combination of its elements, or by double decomposition of a solution of iodide of potassium and a solution of pernitrate or bichloride of mercury. When mercury and iodine are triturated together, in the proportions ordered by the Colleges, the mercury is speedily extinguished, considerable heat is disengaged, and a red loosely-aggregated solid substance is formed, which is biniodide of mercury. Certain precautions however are indispensable for success. If the materials be used dry, the heat disengaged is great, and the mixture at length in general fulminates and is dispersed. To prevent this accident a little rectified spirit is added from time to time during the trituration. Even with that precaution the heat evolved is considerable; so that some iodine generally escapes in vapour. If again the iodine be moist, as generally happens, and due allowance be not made for the moisture, the iodine is not in the proper atomic proportion to the mercury. In either case the product contains some yellow sesquiodide, and the colour is not of the due degree of brightness. But if the materials be used quite pure and in due proportion, if small quantities only be triturated at one time, and if the mixture be kept slightly moist with spirit till union be effected, a pure biniodide of a bright carmine-red colour is obtained. Still the process is one of some nicety, and the product commonly contains more or less sesquiodide or protiodide. Hence the Edinburgh College recommends that it shall be purified by solution in boiling brine and crystallization. The biniodide of mercury is soluble in forty parts of strong brine at the boiling temperature; and when the solution cools, the salt is deposited almost entirely in splendid crimson acicular crystals. The two other iodides are insoluble in boiling brine, and are therefore easily detached by filtration before the solution cools. But they are also easily converted into biniodide, and dissolved in the hot solution, by agitating in it a little of the powder of iodine.

Biniodide of mercury has a beautiful carmine-red colour. When heated to about 400°, it forms a yellow fluid, which sublimes at a farther slight elevation of temperature, and condenses again in splendid golden crystals. These crystals quickly recover their carmine colour if they are cooled rapidly. But if the cooling take place slowly and in a state of complete repose their yellow tint is retained; and the red tint is immediately reproduced if they are touched. Biniodide of mercury is insoluble in water, sparingly soluble in alcohol, but very soluble in various saline solutions, among which the solutions of iodide of potassium and bichloride of mercury are the most remarkable. Its solubility in a boiling solution of common salt, and the application of this property as the means of purifying it, have been already adverted to. Although a boiling solution dissolves it freely enough, a mere trace only is retained on cooling. Biniodide of mercury is composed of one equivalent or 202 parts of mercury, and two equivalents or 252.6 parts of iodine ($Hg\ I^2$).

The object of the characters laid down by the Colleges for ascertaining its purity will be apparent from what has just been said of its chemical properties.

Actions and Uses.—This salt has been recently recommended by some physicians, under the idea that it must combine the deobstruent virtues of both its elements. No proof to this effect however has hitherto been published. And though its effects in strumous disorders are represented to be more speedy than those of iodine itself or the other metallic iodides, farther evidence seems necessary to justify the good opinion entertained of it by some. It is said to possess the property of inducing salivation, like other mercurial compounds; and upon the whole there is reason for thinking that, as a physiological and medicinal agent, it associates itself rather with mercurials than with the preparations of iodine. In large doses it seems to be an irritant poison. It is given internally in the form of tincture or pill, and it is also sometimes applied in the form of ointment to strumous and pseudo-syphilitic sores.

Its dose internally is from one to four grains. Its only officinal form is the *Unguentum hydrargyri biniodidi*, L.

HYDRARGYRI BISULPHURETUM. See *Hydrargyri sulphuretum rubrum.*

HYDRARGYRI CHLORIDUM, *L.* CALOMELAS, *E.* CALOMELAS SUBLIMATUM, *D.* *Chloride or Protochloride of Mercury,—by sublimation. Calomel.*

TESTS, *Edin.* Entirely dispersed by heat; sulphuric ether agitated with it, and then filtered and evaporated, leaves no crystalline residuum; and what residuum may be left is not turned yellow by Aqua potassæ.

TESTS, *Lond.* A whitish powder, which becomes black on the addition of potash, and on being then heated, runs into globules of mercury. Entirely vaporizable. Nitrate of silver, lime-water, or hydro-sulphuric acid, added to distilled water with which it has been washed or boiled, causes no precipitate.

PROCESS, *Edin.* Take of
Mercury, eight ounces;
Sulphuric acid, two fluidounces and three fluidrachms;
Nitric acid, half a fluidounce;
Muriate of soda, three ounces.
Mix the acids, add to them four ounces of the mercury, and dissolve it with the aid of a moderate heat: raise the heat so as to obtain a dry salt. Triturate this with the muriate of soda and the rest of the mercury till the globules entirely disappear: Heat the mixture by means of a sandbath in a proper subliming apparatus. Reduce the sublimate to fine powder; wash the powder with boiling distilled water until the water ceases to precipitate with solution of iodide of potassium; and then dry it.

PROCESS, *Lond.* Take of
Mercury, four pounds;
Sulphuric acid, three pounds;
Chloride of Sodium, one pound and a half;
Distilled water, a sufficiency.
Boil two pounds of the mercury with the acid till a dry bipersulphate of mercury remains. Triturate this with two pounds of mercury in an earthenware mortar till they are intimately mixed; add the chloride of sodium and triturate till the globules disappear. Sublime; reduce the sublimate to very fine powder; wash it carefully with boiling distilled water; and dry it.

PROCESS, *Dub.* Take of
Persulphate of mercury, 25 parts;
Purified mercury, seventeen parts;
Dried muriate of soda, ten parts.
Triturate the persulphate and the mercury together in an earthenware mortar till the globules disappear. Mix with these the muriate of soda; and sublime in a proper apparatus with a gradually-increasing heat. Pulverise the sublimate; wash it with water till solution of caustic potash does not affect the water; and lastly, dry the calomel.

CALOMELAS PRECIPITATUM, *D.* *Chloride or Protochloride of Mercury,—by precipitation.*

PROCESS, *Dub.* Take of
Mercury, seventeen parts;
Diluted nitric acid, fifteen parts.
Pour the acid on the mercury in a glass vessel; and when effervescence has ceased, heat gently for six hours, with occasional agitation. Raise the heat till the mixture boils a little; pour off the liquid, and mix it immediately with a previously prepared solution of seven parts of muriate of soda in four hundred parts of boiling water. Wash the precipitate with warm distilled water till solution of potash ceases to affect the water. Then dry the powder.

PILULAE CALOMELANOS COMPOSITAE, E. D.
PILULAE HYDRARGYRI CHLORIDI COMPOSITAE, L.

PROCESS, *Edin. Dub.* Take of
Calomel and
Golden sulphuret of antimony, of each one part;
Guaiac, in fine powder, two parts;
Treacle, two parts (a sufficiency, D.)
Mix the solids in fine powder, then the treacle, and beat the whole into a proper pill-mass; (to be divided into six-grain pills, E.)

PROCESS, *Lond.* Take of
Chloride of mercury, and
Oxysulphuret of antimony, of each, two drachms;
Resin of guaiac bruised, an ounce;
Treacle, three drachms.
Triturate the chloride and oxysulphuret together, then with the resin, and lastly with the treacle, till a uniform mass be obtained.

PILULAE CALOMELANOS ET OPII, E.

PROCESS, *Edin.* Take of
Calomel, three parts;
Opium, one part;
Conserve of red roses, a sufficiency.
Beat them into a proper mass; to be divided into pills, each containing two grains of calomel.

FOR. NAMES.—*Fren.* Protochlorure de mercure; Mercure doux; Calomélas.—*Ital.* Cloruro di mercurio; Calomelano; Mercurio sublimato dolce.—*Ger.* Einfach chlorquecksilber; Quecksilberchlorür; Versüsstes quecksilber.—*Russ.* Odnochloristaia rtut; Kalomel.

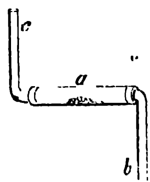
CALOMEL (Chloride of mercury; Protochloride of mercury; Sub-muriate of mercury; Mild muriate of mercury,) has been known since at least the beginning of the seventeenth century. In Scotland, it seems to have been a rare drug so lately as 1666.

Chemical History.—It exists in nature in the form of horn-quicksilver,—a rather uncommon mineral. All the calomel of the shops is prepared artificially by the manufacturing chemist. It may be obtained by two different methods,—in the dry way, by sublimation,—and in the moist way by precipitation. The two varieties thus formed are probably identical in physiological action when well prepared; but sublimed calomel, which was the first known, has always been preferred in medicine.

Sublimed calomel was formerly prepared by heating bichloride of mercury (corrosive sublimate) with the due proportion of mercury for constituting the protochloride. But the three Colleges now agree in recommending the more economical method, first introduced into the Dublin Pharmacopœia, by which calomel is produced directly from the sulphate. The first stage of the process consists in making bisulphate of peroxide of mercury, by dissolving the metal with the aid of heat in sulphuric acid, either with or without the addition of a little nitric acid,—and then raising and continuing the heat till a dry bipersulphate is left, (see *Hydrargyri*

persulphas). The addition of a little nitric acid, which was first recommended by the Dublin College, and is now adopted by that of Edinburgh also, has seemed to me advantageous, as it had also appeared to Dr Barker, by facilitating the oxidation and solution of the metal, and diminishing the quantity of sulphuric and sulphurous acids which must be afterwards driven off. The second stage of the process consists in decomposing the bisulphate by means of chloride of sodium and metallic mercury. For this purpose the three substances are thoroughly triturated together till globules are no longer visible; and the mixture is then subjected to a heat somewhat under low redness, by which calomel is sublimed and condensed in a beautiful, sparkling, crystalline mass. Were no metallic mercury present, the bichloride would be formed. For, each equivalent of bisulphate of peroxide of mercury ($HgO^2 + 2 SO^3$), parting with two equivalents of acid and with the two equivalents of oxygen in its oxide, decomposes two equivalents of chloride of sodium to form two equivalents of sulphate of soda; so that two equivalents of chlorine are set free, to unite with the single equivalent of liberated mercury. But another equivalent of free mercury having been expressly added, according to the process of the Colleges, the bichloride in its nascent state combines with the free metal; and the protochloride is in consequence produced.——As in subliming calomel a small portion is always decomposed, the sublimate in the preceding process is never quite pure, but contains a little mercury and a little corrosive sublimate. The former rises first, and either condenses apart on the upper portion of the vessel, or is found between the vessel and the outer surface of the cake of calomel, from which it may easily be detached. The presence of a little corrosive sublimate renders it necessary to wash the calomel with care. For this purpose the London and Edinburgh Colleges recommend boiling distilled water, while the Dublin College advises common water without heat. The method of performing the process of washing is by no means a matter of indifference. Many spring waters, and among these the water of Edinburgh, promptly decompose calomel if poured over it hot; converting it partially into metallic mercury and corrosive sublimate, the latter of which is dissolved. The Dublin College is therefore right in ordering spring water to be used without heat. Boiling distilled water produces the same effects far more feebly; and if it be poured on the calomel cold and then heated to ebullition, it scarcely exerts any appreciable action. The method of washing by distilled water and ebullition is clearly preferable to the method advised by the Dublin College, because corrosive sublimate is by no means easily soluble in cold water.——An important point in the preparation of calomel is to obtain it at once in a state of very fine division. For attaining this object, Mr Jewel proposed condensing the calomel in water. M. Henry improved on this proceeding, by admitting the vapour into an atmosphere of steam; and this method has been practised

by English manufacturers. Afterwards, M. Dann of Stuttgardt ascertained, that it is sufficient to bring the calomel vapour at the moment of sublimation in contact with a stream of cold air. And more lately Soubeiran has found that it may be accomplished without a current of air, by merely using a very roomy condensing vessel. The effect of air may be shown experimentally by heating calomel with a spirit-lamp in a wide tube *a*, while cold air enters by *b*, and escaping upwards, carries the calomel vapour along with it into *c*.



It seems to have been with the view of obtaining calomel at once in a state of very fine division, that the process by precipitation was proposed as a substitute for the ordinary method by sublimation. Here the first stage consists in dissolving mercury in nitric acid in such way as to form, as far as possible, nitrate of the protoxide only. The Dublin College is wrong in directing a boiling temperature for promoting the action of the acid on the mercury, because in that case a large proportion of the mercury passes into the state of peroxide; and unless the nitrate of protoxide of mercury be crystallized from the solution first formed, and then redissolved, it is scarcely possible to obtain a solution of it entirely free of pernitrate (see *Hydrargyri Acetas*). When this solution is mixed with a solution of common salt, mutual decomposition ensues; the sodium exchanges place with the mercury and becomes nitrate of soda; while chloride of mercury is precipitated. According to Geiger, the surest way to obtain calomel in this mode free of impurity is to dissolve nitrate of protoxide of mercury with the aid of a sufficiency of nitric acid, in sixteen parts of water,—to add to this a solution of chloride of sodium in ten parts of water so long as a precipitate continues to form,—to wash the precipitate immediately with cold water,—and to dry it with a gentle heat in a dark place. It is probably preferable however, for avoiding the risk of the deposition of a basic nitrate, to use an excess of chloride of sodium, and to pour the solution of nitrate of mercury into the solution of the chloride, instead of adding the chloride to the solution of the mercurial salt.

Calomel prepared by sublimation is a fibrous crystalline substance, of sparkling brilliancy, nearly 7.2 in density, soft and brittle, tasteless, and free of odour. Regular crystals of adamantine lustre are sometimes seen on the inside of the sublimed cake; and these, like the mineral horn-quicksilver, when crystallized, are four-sided prisms acuminated by four converging planes. Its colour is white, which becomes yellow where it is cut or scratched with any hard substance. The powder, when formed at once during sublimation, is snow-white; but that obtained by triturating solid fragments of it is yellowish. It becomes dark under exposure to light, probably owing to partial decomposition and the formation of bichloride and free mercury. Heat changes its colour to yellow;

which again gives place to white under refrigeration. A stronger heat, but below redness, sublimes it without previous fusion; and a small portion is at the same time decomposed, mercury and bichloride being formed. Cold water has no action on it. Boiling distilled water has also little action; but if it holds various salts in solution, more especially muriates, and above all muriate of ammonia, partial decomposition ensues, and metallic mercury and bichloride are formed. This action takes place slowly at 120°, but more briskly at 212°. Calomel is insoluble in alcohol or ether. Boiling muriatic acid resolves it into bichloride and mercury; boiling sulphuric acid into bichloride and bisulphate of the peroxide; nitric acid into bichloride and nitrate of the peroxide. Potash, soda, and lime in solution remove its chlorine, which becomes hydrochloric acid by decomposition of water; while the oxygen of the decomposed water converts the mercury into the black protoxide, which separates. Ammonia converts it into a black powder, composed of mercury, chlorine and ammonia in an undetermined state of combination. When heated with alkalis or their carbonates, alkaline chlorides are formed, and mercury sublimes. It is composed of one equivalent of each of its elements ($Hg + Cl$), and consequently of 202 parts of mercury and 35.42 parts of chlorine.——The precipitated calomel differs in no essential respect from sublimed calomel, except that it sometimes contains a trace of basic nitrate, in consequence probably of the muriate of soda not having been used in sufficient quantity. The fixed alkalis and lime-water render it dark gray, not black, as they do sublimed calomel (Göttling).

Adulterations.—Calomel is commonly supposed to be very subject to adulteration, especially with corrosive sublimate. This seems doubtful. I have examined specimens from ten different shops in this city, without finding above a thousandth part of corrosive sublimate in any of them; and in general the pure protochloride, estimated by the proportion of mercury, amounted to 99.5 per cent, the rest being chiefly moisture. Dr Pereira however once met with this dangerous adulteration. The chief impurities to be kept in view are corrosive sublimate, sal-ammoniac, and fixed white powders. The Edinburgh formula of tests will detect them all. Sal-ammoniac will communicate its peculiar taste; corrosive sublimate will be removed by agitation with sulphuric ether, and, on evaporation of the ether, may be discovered by its proper tests, especially caustic potash solution, which turns it yellow; and all fixed substances will be left behind on applying heat sufficient to sublime the calomel. The tests of the London College are not so precise. The colour, the effects of potash, with and without heat, and the effects of heat alone, rather indicate its nature, than determine its purity. The effects of nitrate of silver, lime-water, and hydrosulphuric acid on water which has been used for washing it will detect the presence of corrosive sublimate; for the first will occasion a white precipitate of chloride of silver, the last a black precipitate

of sulphuret of mercury, and if there is a moderate quantity of corrosive sublimate taken up by the water, lime-water will produce a yellow precipitate of peroxide of mercury. A boiling temperature however should not be applied in acting on the calomel with water; for, as explained above, pure calomel will in that case impart some bichloride to the water; and the silver test and the hydrosulphuric acid will act as if corrosive sublimate had been present.

Actions and Uses.—Calomel is the most convenient and most generally applicable of all the mild mercurials. It is not a corrosive; but it possesses every other action of the preparations of this metal. It is irritant, stimulant, antiphlogistic or sedative, cathartic, diuretic, diaphoretic, cholagogue, sialagogue, and alterative. When introduced into the blood it is reduced to the metallic state; and fresh-drawn blood has the same effect (Dr S. Wright). It also undergoes reduction when introduced into the alimentary canal of some animals, or into the cellular tissue (Id.) Its irritant effects on the alimentary canal are so violent in some constitutions as to amount to poisoning; but doubts exist whether it is generally irritant, even in large doses, to such a degree as to be justly considered an irritant poison. Large doses of an ounce or two given to animals cause death not by the local irritation they excite, but by inducing great nervous prostration or severe ptyalism (Wright.) In the human subject, when the alimentary canal is in a state of morbid irritation, as in dysentery, scruple doses of calomel, instead of increasing irritation, produce a sedative or antiphlogistic effect. It has also a sedative or antiphlogistic effect in frequent small doses of three or five grains, especially when united with opium; and on this account it is much used in acute internal inflammations, more particularly after the activity of reaction has been subdued by bloodletting, or where inflammatory action continues after that remedy has been carried as far as appears admissible. It is a cathartic in many instances, even when taken alone, in the dose of five grains; but this effect is rendered more certain and more considerable by combining it with other cathartics. It renders the evacuations greenish. As a cathartic it is held to act particularly by increasing the biliary secretion; a result however, which is also produced by small doses without occasioning marked action on the bowels. Calomel is likewise a diuretic; but this effect is seldom well developed unless it be given with other diuretics, such as squills, digitalis, and the like,—whose influence it seems to increase and render permanent, when it is given in small doses of two grains daily. Its diaphoretic properties are best seen when it is given with other diaphoretics. This action is supposed to be increased when it is united with the golden sulphuret of antimony in the form of Plummer's pill, the *Pilula calomelanos* (*hydrargyri chloridi*, L.) *composita* of the Pharmacopœias,—a preparation the importance of which has been much overrated. The diaphoretic properties of ca-

lomel display themselves most unequivocally when it is united with opium, as in the *Pilulá calomelanos et opii*, E. Three grains of calomel with one of opium, given thrice a-day, or oftener, will sometimes keep up a continuous gentle perspiration in febrile affections better than any other remedy. As an alterative, it is given, like the other mild preparations of mercury, in small doses of one grain daily or two grains every other day. It is on the whole the most convenient of all the compounds of mercury for exciting the peculiar action of this metal on the mouth, and its contemporaneous effect on the general constitution. More especially does this convenience show itself where it becomes desirable to induce mercurial action with rapidity, yet not with violence; for when given in doses of three grains, with a little opium to prevent its action on the bowels, the desired effect may commonly be induced within two days, and with twenty, thirty, or forty grains; nor does the constitutional action thus induced often prove difficult to keep within bounds, if diligently watched and skilfully treated.——On the several statements now made respecting the actions of calomel, farther information will be found under the article *Hydrargyrum*; where the actions and uses of mercurials have been treated of fully in a general way.

Its officinal preparations are, *Calomelas*, E. *Calomelas sublimatum*, D. *Hydrargyri chloridum*, L. gr. xx. sedative; gr. iii. ad gr. vi. cathartic; gr. iij. frequently, antiphlogistic; gr. i. alterative; in all doses, sialogogue. *Pilulæ calomelanos compositæ*, E. D. *Pilulæ hydrargyri chloridi compositæ*, L. gr. v. alterative; gr. x. ad gr. xx. purgative. *Pilulæ calomelanos et opii*, E. i. ad ii. frequently, antiphlogistic and diaphoretic. *Calomelas precipitatum*, D. same as *Calomelas sublimatum*.

HYDRARGYRI CYANURETUM. See *Hydrargyri Bicyanidum*.

HYDRARGYRI IODIDUM, *L.* *Iodide or Protiodide of Mercury.*

TESTS, *Lond.* Yellowish when recent; sublimed by the cautious application of heat in red crystals, which soon become yellow, and then blacken if exposed to light; insoluble in solution of chloride of sodium.

PROCESS, *Lond.* Take of
Mercury, an ounce;
Iodine, five drachms;
Alcohol, a sufficiency;
Triturate the iodine and mercury together, adding alcohol from time to time, until globules are no longer perceptible. Dry the powder as quickly as possible and without the access of light, by means of a gentle heat; and preserve it in well-closed bottles.

PILULAE HYDRARGYRI IODIDI, L.

PROCESS, *Lond.* Take of
Iodide of mercury, a drachm;
Confection of dog-rose, three drachms;
Powder of ginger, a drachm;
Beat them into a uniform mass.

UNGUENTUM HYDRARGYRI IODIDI, L.

PROCESS, *Lond.* To be prepared with iodide of mercury in the same way as ointment of Biniodide of mercury.

FOR. NAMES.—*Fren.* Proto-iodure de mercure.—*Ital.* Proto-ioduro di mercurio.—*Ger.* Einfach iodquecksilber; Quecksilber iodür.

No satisfactory evidence has yet been adduced of the special advantage of any of the iodides of mercury as therapeutic agents. But if any of them is useful, the biniodide is probably the most energetic; and at all events there seems scarcely any reason at present for the admission of more than one into a Pharmacopœia.

The PROTIODIDE is prepared, like the biniodide, either by direct combination of its elements, or by double decomposition. If iodide of potassium and nitrate of protoxide of mercury in solution be mixed together, a mutual interchange takes place, and a protiodide of mercury falls down insoluble. When single equivalents of iodine and mercury are triturated together and kept moist by the occasional addition of a little alcohol, as directed by the London College, the mercury is promptly extinguished, some heat is disengaged, and a yellowish-green solid is formed, which is also the protiodide.

This substance is permanent in the air unless exposed to light, which renders it dark. Heat fuses and sublimes it about the same temperature; and it condenses in red crystals which become yellowish on cooling. Long continued heat decomposes it, resolving it into iodine and mercury. It is sparingly soluble in solution of iodide of potassium, and insoluble in both alcohol and water.

The characters given by the London College are tests of its nature, not of its freedom from impurities.

Dr Cogswell found the iodide of mercury to be an irritant poison of considerable energy. Some have imagined that it may prove a useful remedy in syphilis occurring in strumous constitutions, on the ground that the mercury will eradicate the syphilitic virus, while the iodine will counteract the disturbing influence of the constitutional strumous taint. All hitherto positively known relative to these notions is, that iodide of mercury is capable of producing the physiological effects of mercurials.

The doses of its preparations are: *Hydrargyri iodidum*, L. gr. i. ad gr. v. repeatedly.—*Pilula hydrargyri iodidi*, L. gr. v. ad scr. i. —*Unguentum hydrargyri iodidi*, externally.

HYDRARGYRI MURIAS CORROSIVUM, *D.* See *Hydrargyri Bichloridum.*

HYDRARGYRI NITRATIS UNGUENTUM, *L. D.* UNGUENTUM CITRINUM, *E.* *Ointment of the Nitrate of peroxide of mercury: Citrine ointment.*

PROCESS, *Edin.* Take of
Nitric acid (Dens. 1380 to 1390)* nine fluidounces and a-half;
Mercury, four ounces;
Axunge, fifteen ounces;
Olive-oil, thirty-eight fluidounces and a-half;*
Dissolve the mercury in the acid with the aid of a gentle heat.
Melt the axunge in the oil with the aid of a moderate heat in a vessel capable of holding six times the quantity; and while the mixture is hot, add the solution of mercury also hot, and mix them thoroughly. If the mixture do not froth up, raise the heat a little till this take place. Keep the ointment in earthenware vessels, or in glass vessels secluded from the light.

PROCESS, *Lond.* Take of
Mercury, one ounce;
Nitric acid, eleven fluidrachms;
Lard, six ounces;
Olive-oil, four fluidounces.
Dissolve the mercury in the acid, mix the solution while hot with the lard and oil, melted together.

PROCESS, *Dub.* Take of
Purified mercury, one ounce;
Nitric acid, eleven drachms and a half;
Olive-oil, one (old wine) pint;
Prepared hog's-lard, four ounces;
Dissolve the mercury in the acid; mix the solution with the lard and oil previously melted together; and stir constantly with a glass rod till the mixture becomes stiff.

THE CITRINE OINTMENT is the only form in which the nitrate of mercury is admitted into the Pharmacopœias. It has been long in use.

Chemical History.—The object of the officinal processes for this important ointment has been to imitate as exactly as possible a nostrum well known by the name of the Golden Eye-ointment. This the Colleges long attempted in vain to accomplish; for, unlike the patent article, the officinal ointment was liable to exchange its fine yellow colour for a dirty gray tint, and to become quickly harder and harder, and at length almost pulverizable. The cause of their failure seems to have been that, erroneously conceiving the cause of the spoiling of the ointment to be too much oxidation of the fat from excess of acid, or alteration of it by too high a temperature, they endeavoured to reduce as far as possible not only the heat employed, but likewise the proportion of nitric acid. Mr Duncan, chemist and druggist in this city, was the first, so far as I am aware, to discover, that the Colleges were following out a wrong principle, and that, by ensuring the formation of a nitrate of peroxide of mercury by dissolving the metal in an excess of acid with the aid of heat, using an additional quantity of acid for oxygenating all the fat, and applying a moderate heat at the time of mixing the fat and the metallic solution, so as to ensure complete action between them,—an ointment is obtained not inferior to the quack nostrum in original colour or durability.

The particulars of his process were communicated some years ago to my predecessor, Dr Duncan (see his Dispensatory), and have been adopted by the College of Edinburgh. An oversight has been committed in the College formula from an error made by Dr Duncan. The proportions used by Messrs Duncan and Flockhart are twelve ounces of nitric acid of the density 1380 or 1390, four

* Owing to an accidental error, the proportion of olive-oil has been stated in the Pharmacopœia at 32 fluidounces, and the pure nitric acid of density 1500 has been ordered.

ounces of mercury, fifteen ounces of axunge, and thirty-two ounces of olive-oil,—all taken by avoirdupois weight, and none by measure. I have corrected the College formula accordingly. The best temperature for combining the mercurial solution with the oleaginous materials is about 180° or 190° (Alsop). Almond-oil may be substituted for olive-oil (Id.), but is dearer; rape-seed oil also answers well if freed of acid by digestion with carbonate of magnesia (Pickbourn); butter is likewise a good unctuous substance for the purpose; but other animal fats make an inferior ointment. The London College has approached the proportions given by Mr Duncan, but the Dublin College still follows the old faulty system; as the following table of the respective proportions of the three Pharmacopœias will show :—

	Nitric Acid. D. 1500.	Mercury.	Oil and Lard.
Edin.	6.02 fluidounces.	4 ounces, Tr.	47.0 ounces by weight.
Lond.	5.50 ...	4 ...	37.4 ...
Dub.	4.02 ...	4 ...	71.7 ...

Citrine ointment has a bright yellow colour when newly prepared; and the preparation of Mr Duncan and the Edinburgh Pharmacopœia retains this colour long, if excluded from the light. But many other varieties of it in all circumstances, and even the Edinburgh ointment if exposed to light, gradually pass through grayish-yellow to bluish-gray, and at the same time become hard and crumbly. It is then unfit for use; nor are its qualities restored by triturating it with fresh lard, as is the practice of some. The cause of the change is deoxygenation of the peroxide of mercury. This again is in all likelihood owing to oxygenation of the fatty matters; because it is prevented by a sufficient excess of acid, which, instead of the oxide, supplies the necessary oxygen to the fat,—and because it is greatly accelerated by adding fresh lard to the ointment, as in making an old preparation, the weak citrine ointment. To these presumptions it may be added, that a similar example of deoxidation of peroxide of mercury is well known to occur in the instance of the red precipitate ointment, in which the mercurial oxide is gradually reduced to the metallic state.—The Colleges had once a weak citrine ointment made by diluting the stronger ointment with lard; and it is usual in practice to prescribe an extempore preparation of the kind. In this state decomposition promptly takes place. A superior and permanent preparation is made by the Edinburgh formula with half the mercury, but the same quantity of acid (Duncan and Flockhart).—The composition of citrine ointment is not yet thoroughly known; but it is believed to be a mixture of nitrate of binoxide of mercury with oleïc and stearic acids, and another fatty acid called elaïdic acid, which is produced by the action of nitrous acid on the oleic acid of the olive-oil. The ointment of the Dublin College if prepared with-

out heat in dissolving the metal, must also contain nitrate of the protoxide.

Actions and Uses.—Citrine ointment may act constitutionally as a mercurial, if applied to an absorbing surface for a length of time. In medical practice it is used only on account of its peculiar stimulant qualities as an application to indolent ulcers, to the eyelids when affected with chronic ophthalmia, and to a great variety of cutaneous eruptions, among which those most frequently benefitted are herpes, ringworm, impetigo, sycosis menti, rupia, psoriasis and lepra. It is generally advisable to dilute it at first with one or two parts of axunge, as it is too strong; but such ointment ought not to be kept above a few days. It must not be handled with an iron spatula, or brought in contact with iron in any shape, otherwise the iron is corroded, and the ointment discoloured.

HYDRARGYRI NITRICO-OXYDUM, *L.* See *Hydrargyri oxidum rubrum.*

HYDRARGYRI OXYDUM, *L.* HYDRARGYRI OXYDUM NIGRUM, *D.* *Protoxide of mercury.*

TESTS, *Lond.* Hydrochloric acid, digested with it for a little and filtered, gives no precipitate with potash or with oxalate of ammonia. Entirely soluble in acetic acid: Entirely dispersed by heat.

PROCESS, *Lond.* Take one ounce of chloride of mercury and a gallon of lime-water. Mix and shake them frequently. Set the vessel aside till the oxide falls down, pour off the liquid, wash the oxide with distilled water till the washings have no alkaline taste, and then dry the powder on blotting-paper in the air.

PROCESS, *Dub.* Take of Sublimed calomel, one part; Solution of potash warmed, four parts. Triturate them together till the oxide becomes black; wash it well with water, and dry it with a gentle heat upon bibulous paper.

FOR. NAMES.—*Fren.* Protoxide de mercure.—*Ital.* Protossido di mercurio.—*Ger.* Quecksilber oxydul.

THE preparation of this substance was first pointed out by Moscat in 1797 (Geiger). On the supposition, probably not unfounded, that those preparations of mercury are the mildest in which the metal exists in the form of protoxide, it was at one time conceived that the protoxide itself might be an important addition to the Materia Medica. But it has never come into general use, and in this part of the country has been entirely neglected:—chiefly from its liability to great irregularity, from keeping and from varieties in the mode of preparing it.

Chemical History.—When calomel is triturated with lime-water or solution of potash, it immediately undergoes decomposition, and water is likewise at the same time decomposed. The protochloride of mercury thus becomes hydrochloric acid and protoxide of mercury; the former of which unites with the lime or potash, while the latter separates as a heavy, dark ash-gray powder. This is the process of the Colleges for preparing the protoxide. But it may also be obtained by decomposing with potash a solution of the ni-

trate of protoxide of mercury. In all these processes it is essential, as Mr Donovan has shown, that the decomposing base be constantly in excess, and that heat be not employed; otherwise the powder contains little protoxide, but a mixture of peroxide and mercury. Hence the calomel should be added to the lime-water or potash, and not conversely; there should be so much of the decomposing base as to leave a decided excess at the close; and the employment of heat recommended by the Dublin College is injudicious, unless it be very gentle and carefully regulated.

Protoxide of mercury is a heavy, dark ash-gray powder, without taste or odour. It is exceedingly prone to decomposition under the action of heat, even so low as that of boiling water, and also under that of diffuse light or the direct solar rays. In all these circumstances it is partly resolved into metallic mercury and peroxide, and acquires a yellowish or olive colour. Such is the usual appearance of the protoxide met with in the shops. When pure, it is insoluble in water or in cold muriatic acid, but easily soluble in acetic or diluted nitric acid; and from these solutions it is again thrown down by potash unchanged. A temperature a little above 600° sublimes metallic mercury, leaving peroxide. It is composed of one equivalent or 202 parts of mercury and one equivalent or eight parts of oxygen (HgO).

Adulterations.—This preparation for obvious reasons is often impure, and its most frequent adulteration is with peroxide of mercury. The simplest mode of detecting that impurity is by muriatic acid; which, if digested with the impure protoxide, takes up the peroxide only, and will yield it in the form of a yellow precipitate when filtered and treated with solution of potash in excess. Lime, which may also be present if the London College process be carelessly conducted, will be discovered in the muriatic solution by oxalate of ammonia occasioning a white precipitate of oxalate of lime. Acetic acid will discover metallic mercury by leaving it undissolved. And fixed substances will be detected by a residuum remaining after exposure to a low red heat.

Actions and Uses.—Though the protoxide of mercury has been long in the Pharmacopœias, little is known of its special properties as a mercurial. Unless prepared and preserved with more care than is customary, it must be an inconvenient form for internal use; nor does it seem probable that a perfect protoxide will present any superiority over other familiar preparations. It has been expunged from the Edinburgh Pharmacopœia. An ointment of it was once in use, but has been almost abandoned.—— A lotion made by decomposing calomel with lime-water in the proportion of three or four grains to the ounce, and which consequently contains black oxide of mercury, has long been a favourite local remedy, under the name of Black wash, for venereal sores, and varicose ulcers.

The dose of the protoxide is from one to five grains.

HYDRARGYRI OXYDUM RUBRUM, E. HYDRARGYRI NITRICO-OXYDUM, *L.* HYDRARGYRI OXYDUM NITRICUM, *D.* *Peroxide of Mercury. Binoxide of Mercury. Red Precipitate.*

TESTS, *Edin.* Entirely soluble in muriatic acid: Heat decomposes and sublimes it entirely in metallic globules, without any discharge of nitrous fumes.

TESTS, *Lond.* It does not emit nitrous vapours when heated. Water, in which it is boiled or washed, yields no precipitate to lime-water or hydrosulphuric acid. It is entirely soluble in hydrochloric acid. When heated it gives off oxygen, and mercury is left in globules, or it is entirely dispersed.

PROCESS, *Edin.* Take of
Mercury, eight ounces;
Diluted nitric acid of density 1280, five fluidounces.
Dissolve half of the mercury in the acid with the aid of gentle heat; and continue the heat till a dry white salt be left. Triturate the rest of the mercury with the salt till a fine uniform powder be obtained; heat the powder in a porcelain vessel and constantly stir it, till acid fumes cease to be disengaged.

PROCESS, *Lond.* Take of
Mercury, three pounds;
Nitric acid, three pounds and a half;
Distilled water, two pints.
Mix in a proper vessel, and apply a gentle heat till the mercury is dissolved. Evaporate the liquid, and pulverize the residuum. Put this into a very shallow vessel, and apply a gentle heat, gradually increasing, until red vapours cease to be discharged.

PROCESS, *Dub.* Take of
Purified mercury, two ounces;
Diluted nitric acid, three ounces by measure.
Dissolve the mercury in the acid contained in a glass vessel with a heat gradually increased; then raise the heat till the residuum be converted into red scales.

HYDRARGYRI BINOXYDUM, *L.* HYDRARGYRI OXYDUM RUBRUM, *D.* *Peroxide of Mercury.*

TESTS, *Lond.* Heat disengages oxygen, and mercury is left in globules or sublimes; hydrochloric acid dissolves it entirely.

PROCESS, *Lond.* Take of
Bichloride of mercury, four ounces;
Solution of potash, twenty-eight fluidounces;
Distilled water, six pints.
Dissolve the bichloride of mercury in the water and add the solution of potash. Let the precipitate subside, pour off the liquor, wash the precipitate with distilled water till the water ceases to taste alkaline. Then dry the precipitate with a gentle heat.

PROCESS, *Dub.* Put any quantity of mercury into a mattrass with a long neck and narrow mouth. Expose it to about the temperature of 600° till the metal be converted into red scales.

UNGUENTUM OXYDI HYDRARGYRI, E. UNG. HYDR. NITRICO-OXYDI, L.—UNG. HYDR. OXYDI NITRICI, D.

PROCESS, *Edin.* Take of
Red oxide of mercury, one ounce;
Axunge, eight ounces.
Triturate them into a uniform mass.

PROCESS, *Lond. Dub.* Take of
Nitrico-oxide of mercury, an ounce;
White wax, two ounces;
Lard, six ounces.
Melt the lard in the wax, add the oxide in very fine powder, and mix the ingredients thoroughly.

FOR. NAMES.—*Fren.* Peroxide de mercure; Oxide rouge de mercure.—*Ital.* Deutossido di mercurio; Ossido rosso di mercurio.—*Ger.* Quecksilberoxyd; Rother quecksilber-präcipitat.—*Russ.* Krasnaia rtutnaia okis.

THE RED OXIDE OF MERCURY (Binoxide, Deutoxide, or Peroxide of mercury, Red precipitate) appears to have been known since the eighth century.

Chemical History.—It may be prepared in three different ways, —by the slow oxidation of mercury under the united influence of

heat and atmospheric air,—by decomposition of the nitrate of mercury under the action of heat,—and by decomposing corrosive sublimate by potash. All of these processes have obtained a place in one or another of the British Pharmacopœias. The first is scarcely ever practised except for curiosity, because the long period of a month or upwards is required to complete it. It consists in subjecting mercury to a subliming heat in a vessel with a flat bottom and tall narrow neck open at top, so that the metallic vapours fall back into the body of the vessel as fast as they condense, while the air is at the same time constantly renewed. The mercury, in the course of its repeated sublimations, becomes oxidated at the expense of the oxygen of the air; and at length grayish-red scales are slowly formed. The oxide thus prepared was formerly called the Red precipitate *per se*, and was conceived to possess important advantages over the common red precipitate prepared by decomposing the nitrate, in so far as it was thought milder and less irritating. This however is in all probability a mistake.——The more common process for obtaining red oxide of mercury is by dissolving the metal in nitric acid, and then expelling the acid by a moderate heat. With the proportions of acid and metal recommended by the Colleges, and under the action of a moderate heat, the mercury is converted into peroxide at the expense of some of the nitric acid, and with the disengagement of nitric oxide gas. There is thus obtained in the first instance a nitrate of peroxide of mercury. When a stronger and gradually-increasing heat is cautiously applied to this salt, its acid is decomposed and driven off; and by continuing the process till ruddy fumes of nitrous acid cease to be discharged, a pure peroxide of mercury is at length obtained, of a fine scarlet or orange colour, and more or less scaly in appearance. The process is rendered more economical, according to the directions of the Edinburgh College, by triturating the nitrate of mercury with a certain proportion of metallic mercury before decomposing it; because the nitric acid, which would otherwise be discharged, is in that case partly employed in oxidating the mercury, and a considerable saving is consequently accomplished both of time and of acid. A fanciful importance was long generally attached, and is still attached by some, to obtaining the oxide by this method in the form of large scales. These are said to be best prepared by operating on a large quantity of materials at once, decomposing the salt gradually in the vessel in which it is first formed, and maintaining the heat uninterruptedly. But in point of fact the scaly form in which the red oxide is usually sold is an inconvenience, rather than an advantage, for pharmaceutic and medicinal purposes; and it is preferable, as in the processes of the Edinburgh and London Pharmacopœias, to obtain the oxide at once in the state of powder. For this purpose the nitrate should be thoroughly pulverized before it is decomposed.——The third method of pre-

paring red oxide of mercury is by decomposing the solution of corrosive sublimate by caustic potash. If the bichloride be viewed as dissolving in the form of hydrochlorate of peroxide of mercury, then the potash must be considered as combining with the hydrochloric acid, so as to disengage the peroxide; which falls down in the form of a yellow powder. This, according to Berzelius, is a hydrated oxide; and when dried at a moderate heat, it parts with its water, and becomes the orange-coloured anhydrous peroxide. For the success of the present method, it is essential that the potash be always in excess; otherwise, a basic salt may be thrown down along with the oxide, and impart to it a brownish tint (Berzelius).

Of the three processes now described, the Edinburgh College admits only that by decomposition of the nitrate of mercury; while the London College adds the method by decomposition of corrosive sublimate, and the Dublin College the old tedious mode by sublimation and atmospheric oxidation. The two latter processes have been adopted,—and the product of the first process designated in the English and Irish Pharmacopœias by a separate name (*nitrico-oxydum; oxydum nitricum*),—under the supposition that, when the oxide is prepared by decomposing the nitrate with heat, it is more acrid than the pure peroxide, and contains a little nitric acid. But when well prepared, the nitrico-oxide is not at all more acrid than the peroxide prepared by any other process, and contains either no nitric acid, or an insignificant trace only. There is therefore no occasion for loading the Pharmacopœias with more than one process; and that by decomposition of the nitrate should be preferred as being the cheapest and most convenient.

The red oxide of mercury when prepared by heat alone from the metal has a grayish-red hue; but that obtained by decomposing the nitrate with heat has a scarlet colour when in scales, an orange tint inclining to yellow when in powder, a density about 11.0, and a taste at first scarcely appreciable, but afterwards metallic and disagreeable. When long exposed to light it is partially reduced. Heat renders it first dark-red, then violet, and at length dark brownish-black; but it recovers its original colour on cooling. A temperature somewhat higher decomposes it, first disengaging oxygen gas, and then subliming mercury. It is sparingly soluble in water. This has been denied. But I find that in whatever way it is prepared, and however carefully it may be washed, boiling water dissolves about a 7000th part of it, and forms a solution which yields a black precipitate with sulphuretted-hydrogen, a gray precipitate with protochloride of tin, and a yellow one with bichromate of potash. It is very soluble in hydrochloric, acetic, and hydrocyanic acids. It undergoes reduction when mingled with fatty matters. This is exemplified in the familiar Red-precipitate ointment, the *Unguentum oxydi hydrargyri;* which passes gradually from a bright scarlet colour to grayish-red, and eventually to

bluish-gray. No means hitherto tried to prevent the alteration have proved effectual. It is of some advantage however to use old axunge that has been exposed for some time in thin layers to the air, and to exclude the ointment from the light by keeping it in earthenware vessels.——The peroxide of mercury consists of one equivalent of metal and two of oxygen (HgO^2), and therefore of 202 parts of the former and 16 of the latter.

Adulterations.—The red oxide of mercury is not much subject to adulteration, as met with in the shops of this country. The impurities which have been indicated are nitric acid, red oxide of iron, red oxide of lead, and brick dust. The absence of the whole of these may be ascertained by the effects of heat, as laid down by the Edinburgh and London Colleges. If nitric acid be present, ruddy fumes will be disengaged, or, a little yellow basic nitrate of mercury may be sublimed (Clark). Should brick dust, or the oxide of iron or of lead be present, heat will not entirely disperse it. Nitric acid will leave brick dust and red oxide of lead, changing the latter to the brown peroxide. Another impurity indicated in some pharmaceutic works, and provided against by the London College, is corrosive sublimate; but I have never met with this adulteration. It is detected by the action of lime-water on water boiled with the oxide,—a yellow precipitate of peroxide of mercury being occasioned. The London College is wrong however in directing this water to be also tested with sulphuretted-hydrogen, because the pure oxide is sufficiently soluble in boiling water, to form a solution which yields a black sulphuret with that reagent.

Actions and Uses.—Red oxide of mercury is an irritant poison of considerable activity; but it is not a corrosive as some imagine. It is now very seldom used internally, although it has occasionally been given as a mercurial in the dose of one or two grains in the form of pill. As an external remedy it is extensively employed for a variety of purposes;—such as in the form of powder for stimulating indolent ulcers or exuberant granulations, and in that of ointment as a stimulant application for indolent ulcers, chronic eruptions of the vesicular and pustular classes, chronic inflammation of the eyelids, &c.——A lotion, made by decomposing corrosive sublimate by lime-water, in the proportion of one grain per fluidounce, and which consists essentially of red oxide of mercury suspended in the fluid, is a favourite local application with many for chancres and venereal excoriations under the trite name of Redwash.*

The officinal preparations are *Hydrargyri oxydum rubrum*, E. *Hydrargyri oxydum nitricum*, D. *Hydrargyri nitrico-oxydum*, L. gr. i. ad gr. iii.—*Hydrargyri binoxydum*, L. *Hydrargyri oxydum rubrum*, D. gr. i. ad gr. iii.—*Unguentum oxydi hydrargyri rubri*, E. *Unguentum hydrargyri nitrico-oxydi*, L. *Unguentum oxydi nitrici hydrargyri*, D. externally.

HYDRARGYRI OXYDUM SULPHURICUM, *D.* *Subsulphate of Mercury.* *Turbith-mineral.*

PROCESS, *Dub.* Take of
Persulphate of mercury, one part;
Warm water, twenty parts.
Triturate them in an earthen mortar; pour off the liquor; wash the yellow powder with distilled water till solution of potash has no effect on the washings; then dry the sulphuric oxide of mercury which remains.

FOR. NAMES.—*Fren.*—Sous-deutosulfate de mercure; Turbith minéral.—*Ital.* Sotto-solfato di deutossido di mercurio; Turbitto minerale.—*Ger.* Basisch schwefelsaures quecksilberoxyd; Mineralischer turpith.

TURBITH-MINERAL is an old mercurial preparation, known since the sixteenth century, but now almost neglected in this country.

Chemical History.—When bisulphate of peroxide of mercury (see *Hydrargyri persulphas*) is triturated with water it is decomposed; the water takes up a small quantity of the oxide dissolved in a large excess of sulphuric acid; and a beautiful yellow insoluble basic salt is left, formerly known by the name of Turbith-mineral, afterwards denominated in the Pharmacopœias Yellow subsulphate of mercury, and now incorrectly termed by the Dublin College sulphuric-oxide of mercury.

Subsulphate of mercury is a heavy, lemon-yellow powder, of an acrid, slowly developed, metallic taste, destitute of odour, but powerfully irritating to the nostrils when inhaled in fine dust. It becomes gray under long exposure to light. It is soluble in 600 parts of boiling water and in 2000 parts at the temperature of 60°. When heated, it first gives off sulphurous acid, then oxygen, and at length mercury is sublimed. It consists, according to Geiger and Dr Barker, of one equivalent of each element,—according to Phillips, of four equivalents of peroxide of mercury and three of sulphuric acid, that is 872 of base and 120.3 of acid.

Actions and Uses.—The subsulphate of mercury is in large doses an irritant poison,—in doses of two or four grains an emetic,—mixed with inert vegetable powders a good errhine,—and in small doses a sialagogue. It is on the whole an unnecessary mercurial, and may be expunged from the Pharmacopœias.

HYDRARGYRI PERSULPHAS, *D.* *Bisulphate of Mercury.*

PROCESS, *Dub.* Take
Purified mercury and
Sulphuric acid, of each six parts;
Nitric acid, one part.
Heat them together in a glass vessel, and increase the heat till the mass be obtained dry.

FOR. NAMES.—*Fren.* Sulphate de mercure.—*Ital.* Solfato di perossido di mercurio.—*Ger.* Schwefelsaures quecksilberoxyd.

THE BISULPHATE OF MERCURY is not used in medicne, but has been introduced by the Dublin College as a salt obtained in the

first stage of the preparation of corrosive sublimate, calomel, and the yellow subsulphate. Although not specifically mentioned by the other Colleges, its formation is nevertheless implied in their processes for making calomel and corrosive sublimate.

Chemical History.—When mercury is brought in contact with sulphuric acid, no action takes place in the cold. But if two parts of metal and three of acid be subjected to a moderate heat, somewhat under the boiling point of sulphuric acid, a portion of the acid is decomposed, and sulphurous acid gas is given off; the mercury is oxidated and combines with the remainder of the sulphuric acid; and a white crystalline sulphate is formed, which is sparingly soluble in water, yields a black protoxide of mercury when decomposed with excess of caustic potash, and is therefore a sulphate of the protoxide. But if a stronger heat be used from the first, or if, after complete solution of the mercury in the form of protoxide, the heat be continued till a dry salt is left, the mercury becomes peroxidated at the expense of more of the sulphuric acid, and a white bisulphate of peroxide of mercury is obtained. The object of the addition of the nitric acid in the Dublin formula is to facilitate the oxidation of the metal and diminish the quantity of sulphuric acid in the process. For according to Dr Barker, the mercury is oxidated chiefly at the expense of the nitric acid, and is thus simply combined with the sulphuric acid, without any material portion of that acid being decomposed.

The bisulphate of peroxide of mercury is a dry white crystalline salt which cannot be dissolved in water, because when mingled with that fluid it undergoes decomposition, forming an insoluble yellow basic sulphate (see *Oxydum hydrargyri sulphuricum*). The bisulphate when triturated with an excess of solution of caustic potash yields by decomposition the yellow peroxide of mercury.

Actions.—There can be no doubt that this salt possesses active irritant properties like the other salts of mercury, and that in small doses it will act as a mercurial; but it has not been used medicinally.

HYDRARGYRI PRECIPITATUM ALBUM, *E.* HYDRARGYRI AMMONIO-CHLORIDUM, *L.* HYDRARGYRI MURIAS AMMONIATUM, *D.* *An unascertained compound; most probably of one equivalent of bichloride of mercury and one equivalent of binamide of mercury.—White precipitate.*

Tests, *Lond.* It is entirely sublimed by heat: acetic acid digested on it is not precipitated yellow or blue by iodide of potassium: lime-water does not blacken it: hydrochloric acid dissolves it without effervescence: it becomes yellow and gives off ammonia when heated with solution of potash.

Process, *Edin. Lond.* Take of
Corrosive sublimate, six ounces;
Distilled water, six pints;
Aqua ammoniæ, eight fluidounces.

Dissolve the corrosive sublimate in the water with the aid of heat; when the solution is cold add the ammonia; stir the whole well; collect the powder (on a calico filter, E.), and wash it thoroughly with cold water.

PROCESS, *Dub.* After making Precipitated Calomel, add solution of ammonia to the residual liquor so long as a precipitate forms: wash the precipitate with cold distilled water, and dry it on bibulous paper.

UNGUENTUM PRECIPITATI ALBI, E.

UNG. HYD. AMMONIO-CHLORIDI, L. UNG. HYD. SUBMURIATIS AMMONIATI, D.

PROCESS, *Edin. Lond. Dub.* Take of White precipitate, two drachms: Axunge, three ounces.

Melt the axunge, add the white precipitate, and stir briskly as the ointment concretes in cooling.

FOR. NAMES.—*Fren.* Oxichlorure ammoniacal de mercure; Sel Alembroth.—*Ital.* Muriato di mercurio e d'ammoniaca insolubile; Precipitato bianco.—*Ger.* Basisch quecksilberoxyd-ammoniak; Weisser quecksilber-prëcipitat.—*Russ.* Chloristaia ammoniakalnaia rtut; Velaia osadotschnaia rtut.

WHITE PRECIPITATE (cosmetic mercury, muriate of mercury and ammonia, &c.) has been known since the fifteenth century, when it was discovered by Reymund Lully.

Chemical History.—The Pharmacopœias formerly directed it to be prepared by decomposing a solution of bichloride of mercury and muriate of ammonia by means of carbonate of potash. The Edinburgh and London Colleges now obtain it more directly by precipitating the solution of bichloride of mercury with ammonia. The Dublin College, which alone retains precipitated calomel, and prepares it by adding muriate of soda to solution of nitrate of mercury, turns to use the nitrate of peroxide of mercury which remains after the calomel is thrown down, and obtains from it the white precipitate by adding ammonia,—the chlorine (or muriatic acid) being supplied by the excess of muriate of soda previously introduced into the fluid.

White precipitate is a heavy white powder, without odour, but of an unpleasant metallic taste. Heat decomposes it and resolves it into calomel, ammonia and azote. It is insoluble in water; but boiling water, or long continued washing with cold water, renders it yellow by resolving it into muriate of ammonia and peroxide of mercury. Muriatic acid dissolves it and converts it into muriate of ammonia and corrosive sublimate. Nitric and sulphuric acids also dissolve and decompose it. The caustic alkalis resolve it into alkaline muriates, peroxide of mercury, and ammonia. Its nature and composition are still doubtful. The most probable view is that of *Dr Kane*, who found that, on ammonia being added in slight excess to solution of bichloride of mercury, one-half of the chlorine is set free, and that the precipitate contains an equal number of equivalents of mercury, chlorine, and the radical of ammonia termed amidogen (NH^2). From other circumstances he infers that these constituents are present to the amount of two equivalents of each, and that they are so united as to constitute a compound of one equivalent of bichloride and one equivalent of binamide of mercury

($Cl^2Hg + Ad^2Hg$), and consequently of 272.84 parts of bichloride and 235.8 parts of binamide.

Adulterations.—This preparation is not subject to be adulterated, and the Edinburgh College has therefore thought it unnecessary to give any tests of its purity. The characters supplied by the London College, besides being intended to point out its nature, contemplate adulteration with carbonate of lead, starch, calomel, and chalk. The first and second of these impurities are detected by the yellow and blue precipitates formed by iodide of potassium in diluted acetic acid digested on the powder, the third by lime-water rendering it dark, and chalk by muriatic acid causing effervescence.

Actions and Uses.—White precipitate is probably an irritant, but not an active one. It possesses the peculiar constitutional actions of the mercurial compounds generally. In the time of Boerhaave it was employed internally as a mercurial; but is now only used as an external application. It is an excellent topical stimulant for indolent ulcers, especially those connected with syphilis. Excoriations on the penis are often quickly healed by it, also superficial ulcerations consequent on chronic eruptive diseases. It is likewise a useful application for chronic pustular eruptions; whence one of its old names, Cosmetic mercury. The only form in which it is now employed in Britain is that of ointment, for which the Pharmacopœias contain a formula.

HYDRARGYRI SULPHURETUM NIGRUM, *D.* HYDRARGYRI SULPHURETUM CUM SULPHURE, *L.*

Exact composition and nature doubtful.

Tests, *Lond.* It is entirely dispersed by heat in vapour, without any charcoal or phosphate of lime being left.

Process, *Lond. Dub.* Take of Mercury, one pound (part D.) Sulphur, one pound (part D.) Triturate them together (in an earthen mortar, D.) till the globules disappear.

For. Names.—*Fren.* Sulfure noir de mercure; Æthiops mineral.—*Ital.* Solfuro di mercurio persolforato; Etiope minerale.—*Ger.* Schwarzes schwefelquecksilber; Mineralisches mohr.—*Russ.* Tschernaia sernistaia rtut.

This substance has been known under the name of Ethiops mineral from a remote period; and the method of preparing it by trituration of its ingredients has been practised since the close of the seventeenth century.

Chemical History.—The extinction of mercury by means of sulphur is not very easily accomplished. The most approved method is to operate on small quantities at a time, and to moisten the mixture occasionally with a little water. But Geiger states that, with the aid of a little solution of hydrosulphate of ammonia, extinction may be perfected in a short time, and a compound obtained which is identical with that produced by the trituration of mercury and

sulphur alone. When the extinction is complete, a black powder results, in which no globules are visible even with a magnifier.

Some doubt exists in respect to the exact nature and composition of Ethiops mineral. It is a black tasteless powder, insoluble in water. According to Mr Brande, caustic potash in solution removes sulphur from it at a boiling temperature and leaves a black powder; which, when sublimed, presents the characters of cinnabar or bisulphuret of mercury. This analysis would indicate it to be an intimate mechanical mixture of bisulphuret and sulphur. According to Geiger it is a mixture of bisulphuret, sulphur, and uncombined mercury; which however appears doubtful, if, as some have stated, nitric acid has no action on it; for if free mercury were present it would be dissolved. There seems no good reason for supposing, with Dr Barker and others, that it is a mixture of sulphur and protosulphuret of mercury. Doubts are even entertained whether a protosulphuret of this metal is yet known at all, as obtained by any process; for the black substance, produced by the action of sulphuretted hydrogen on solutions of the salts of protoxide of mercury, and which Turner and other chemists consider a true protosulphuret, has been found by Guibourt to yield globules of mercury by mere expression.

Adulterations.—The black sulphuret of mercury is subject to be adulterated with various black powders, more especially charcoal and ivory-black. Both may be detected, according to the London formula, by means of heat, which dispels the whole sulphuret and leaves the fixed substances. If the residue be incinerated, a white powder of phosphate of lime will be left where ivory-black was the adulterating ingredient.

Actions and Uses.—This preparation was once employed internally as an alterative and diaphoretic chiefly in cutaneous diseases; and it has been considered peculiarly applicable to the treatment of scabies. Some have used it as an anthelmintic, others as a mercurial in syphilis. It really appears however to be a feeble preparation, if not almost inert, and may be safely expunged from the Pharmacopœias.

The dose formerly given varied from five to twenty grains.

HYDRARGYRI SULPHURETUM RUBRUM, *D.* CINNABARIS, *E.* HYDRARGYRI BISULPHURETUM, *L.* *Bisulphuret of mercury. Cinnabar.*

TESTS, *Edin.* It is sublimed entirely by heat, and without any metallic globules being formed.

TESTS, *Lond.* It is sublimed entirely by heat, yields globules of mercury when heated with potash, and is dissolved by nitro-hydrochloric acid, but neither by hydrochloric nor nitric acid singly. Boiling rectified spirit is not reddened by it; and acetic acid digested upon it does not yield a yellow precipitate with iodide of potassium.

PROCESS, *Edin. Lond. Dub.* Take of Mercury, two pounds (21 parts, D.), Sulphur, five ounces (3 parts, D.) Melt the sulphur, add the mercury, and

continue the heat till the mixture begins to swell up. Then remove the vessel, and cover it closely to prevent the mass taking fire. When the material is cold, reduce it to powder and sublime it.

FOR. NAMES.—*Fren.* Deutosulfure de mercure; Sulfure rouge de mercure; Cinabre.—*Ital.* Deuto-solfuro di mercurio; Cinabro.—*Span.* Cinabrio.—*Ger.* Rothes schwefelquecksilber; Zinnober.—*Dut.* Vermiljoen.—*Russ.* Krasnaia sernistaia rtut.

CINNABAR (Vermilion, Red sulphuret of mercury, Bisulphuret of mercury) has been used in the arts from remote antiquity, for it has been found in pigments from the tombs of the ancient Egyptians. It was known to the Greeks under the name of Κινναβαρι, and to the Romans by that of *Minium*,—terms however which seem to have been also applied to various other substances resembling it in colour. The Greek name adopted by the Edinburgh College, and long familiarly applied to it in modern times, appears the best pharmaceutic designation.

Chemical History.—Cinnabar is met with in nature, though not abundantly, in the form of a beautiful, vermilion-coloured, and often regularly crystallized ore, called by mineralogists Native cinnabar. But what is used in medicine and the arts is all prepared artificially. It may be obtained both in the moist and dry way. In the moist way, it is thrown down in the form of a grayish-black powder when sulphuretted-hydrogen is transmitted through a solution of corrosive sublimate. Bucholz too showed that it may be prepared of fine quality by gently heating in a bottle four parts of mercury, one of sulphur, three of potash, and six of water, till the mercury is extinguished, and then keeping it in a warm place, with occasional agitation, till the powder, which is at first black, acquires a fine red tint. In the dry way cinnabar is made on the large scale by a process essentially the same with that of the Pharmacopœias,—namely, by heating its constituents together till they unite, and then subliming the product. The chief nicety in the process is to produce an article of a bright vermilion colour. For a long time the secret for obtaining the proper tint was possessed only in China; which accordingly supplied Europe till of late with the finest vermilion. Afterwards the Dutch discovered the secret and kept it for some time. But it is now known to manufacturers in various quarters; and fine vermilion is largely prepared in this country. The precautions required for complete success are still not currently known. But the most material points are believed to be, to operate on a large scale, to drive off all excess of sulphur before sublimation, and to subject the sublimate for a short time to a rather strong heat. It has also been observed that when the colour is deficient in brightness, it is heightened by exposing the powder for some weeks or months in a dark place to the action of distilled water or very weak nitric acid (Payssé).

Cinnabar is sold in the shops in two forms, in mass and in pow-

der. When in mass, as originally sublimed, it constitutes a ponderous, dark brownish-red, striated substance, of metallic brilliancy, very friable, and yielding a fine vermilion streak when scratched with the nail. When in powder it is equally ponderous, and of a splendid red tint, intermediate between crimson and scarlet. It has a density of 8.1, is without taste or odour, and does not undergo change in the air. When heated, its colour is exchanged for a dull brownish-red. At a higher temperature it takes fire if exposed, but in close vessels sublimes unchanged, except in so far as it loses its fine vermilion tint and becomes dull brownish-red, as when simply heated. If heated with the fixed alkalis or their carbonates, or with iron, copper, or most fixed metals, it is decomposed and mercury is sublimed. It is insoluble in water, alcohol, and ether,—in alkaline solutions,—and in sulphuric, nitric, muriatic, and acetic acids; but nitromuriatic acid dissolves it, producing bichloride of mercury and sulphate of the peroxide. It is composed of one equivalent or 202 parts of mercury, and two equivalents or 32 parts of sulphur (HgS^2).

Adulterations.—The high price of cinnabar subjects it to frequent adulterations, among which the most important are with red lead, red oxide of iron, brick-dust, and realgar, one of the native sulphurets of arsenic. The tests given by the Colleges will detect all these impurities except the last. If any of the first three be present, a residuum will appear after the application of a red heat; and if the impurity be red lead, which is the most frequent adulteration, metallic globules are sublimed. Realgar is never met with as an adulteration in this country. It may be detected by boiling the cinnabar in solution of potash, supersaturating the filtered liquid with muriatic acid, and transmitting sulphuretted-hydrogen; upon which the yellow sulphuret of arsenic is thrown down. The London College, as usual, gives many characters which are not intended to detect adulterations, but merely to determine the nature of the substance.

Actions and Uses.—When mercurial fumigations were in vogue for the venereal disease, cinnabar was commonly preferred for the purpose. Half a drachm thrown upon a hot plate, and directed into the fauces by inspiring over it, will generally produce salivation, and has been thought serviceable also as a topical remedy for syphilitic ulceration of the throat. This method is now abandoned, as it was found to be apt to induce violent ptyalism. Cinnabar appears to be inert internally. Its activity in the way of fumigation depends on the mercury being oxidated by the air in the act of subliming.

HYOSCYAMUS, *E.* HYOSCYAMI FOLIA, *L. D.* *Leaves of Hyoscyamus niger, L. W. Spr.—Henbane.*

HYOSCYAMI SEMINA, *L.* *Seeds of Hyoscyamus niger.*

EXTRACTUM HYOSCYAMI, E. L.

PROCESS, *Edin.* This extract is to be prepared by any of the processes directed for extract of Conium.

SUCCUS SPISSATUS HYOSCYAMI, D.

PROCESS, *Lond. Dub.* To be made like extract of Aconite.

TINCTURA HYOSCYAMI.

PROCESS, *Edin.* Take of
Hyoscyamus dried, and in moderately fine powder, five ounces;
Proof-spirit, two pints.
This tincture is best prepared by the process of percolation, as directed for tincture of Capsicum; but it may also be obtained, though with greater loss, by the process of digestion.

PROCESS, *Lond. Dub.* Take of
Dried hyoscyamus leaves, five ounces;
Proof-spirit, two (old wine, D.) pints.
Macerate for fourteen days, and strain.

FOR. NAMES.—*Fren.* Jusquiame.—*Ital.* Giusquiamo.—*Span.* Beleno.—*Port.* Meimendro.—*Ger.* Bilsenkraut.—*Dut.* Bilsenkruid.—*Swed.* Bolmört.—*Dan.* Fandensnosser; Honsebane.—*Russ.* Vlekota; Velena.—*The seeds. Arab.* Buzirulbunj.—*Tam.* Korasanie omum.—*Hind.* Khorassanie-ajooan.

Hyoscyamus niger figured in Nees von E. 192.—Hayne, i. 28.—Eng. Bot. 591.—Steph. and Ch. i. 9.

HENBANE is a very old article of the Materia Medica, being ascertained to have been the Ὑοσκύαμος of Dioscorides, by whom it was much used inwardly and outwardly as an anodyne. It was long nearly lost sight of in modern medicine, until Störck recommended it along with other narcotic vegetables in 1762.

Natural History.—Several species of Hyoscyamus possess analogous properties; but the best known, most abundant, and only officinal species is the *Hyoscyamus niger*. It belongs to Linnæus' class and order *Pentandria Monogynia*, and to the Natural family *Solanaceæ*. It is generally biennial, but an annual variety is cultivated by the herb-gardeners at Micham near London. The biennial variety grows on roadsides, and uncultivated hill-slopes in this island and most continental countries of Europe; and it is also cultivated for the druggist. It throws out root-leaves only during its first summer, and in the subsequent spring pushes up a shrubby, hairy, viscous stem, from a foot and a half to four feet high. The plant is then covered with large, pale green, very sinuous, hairy, somewhat viscous leaves, and bears several flowering branches, which produce in succession from June to August many axillary, dingy-yellow flowers, intricately crossed by purple reticulations. The capsule is bilocular, and contains numerous rough, pale-grayish-brown, slightly flattened, ovate or reniform seeds, rather less than those of the poppy. The root is spindle-shaped, somewhat woody, but amylaceous, white and plump. The fresh herb has a peculiar unpleasant odour, and a mawkish taste. The chief officinal part is the leaves. The London College adds also the seeds, but perhaps unnecessarily; for, though stronger than the leaves, it is troublesome to collect them in large quantity. The seeds ripen from August to October. It is almost universally recommended to gather the leaves only from wild plants, and their superior activity is stated to have been ascertained in Germany (Mérat); but from experiments made some years ago at the Royal Infirmary here, the inferiority of cultivated plants, if it exists at all,

seems not appreciable in practice. A difference of opinion prevails as to the proper period for collecting the leaves. It has been alleged, that those of the first year are inert, that stem leaves only should be used, and that they should be collected at the beginning of inflorescence (Houlton) or just before it (Duncan); but I have found them sufficiently active even in the spring, before the appearance of the flowering stem. The annual variety pushes up its flowering stem at once in the month of May, and flowers nearly at the same time with the biennial variety. Their relative activity has not been ascertained. The annual plant has been thought to be comparatively feeble in energy. But Dr Royle found it active, as grown in India. The two varieties are used indiscriminately by many London druggists for making the officinal extract.—Henbane-leaves should be dried for preservation without artificial heat (Houlton), or in a hot-air-press not above 120° in temperature. They are in good preservation, if they retain in some measure their peculiar odour, and possess a mawkish, obscurely bitter taste. The druggist's store of them ought to be renewed every year.

Chemical History.—Hyoscyamus leaves yield by expression a large quantity of juice, in which the properties of the plant reside. From this is prepared the officinal *Extractum Hyoscyami.* A pound of leaves yields eight or nine drachms of extract (Geiger). The best mode of preparing it is by evaporating the juice spontaneously in shallow vessels, exposed to a brisk current of air, or by performing this process in vacuo, or by bringing the juice to the consistence of thin syrup in the latter way, and then rendering it nearly dry by spontaneous evaporation. All of these methods are now followed by different druggists in Edinburgh; and they have been adopted by the Edinburgh College in the last edition of its Pharmacopœia. The ordinary mode by evaporation over the vapour-bath, still followed in the formulas of the two other Colleges, yields an inferior extract; for the active principle of the plant is decomposed by prolonged heat. When well prepared, the extract of henbane has a lively green colour, and a peculiar odour, free of the syrupy taint common to most extracts prepared at a boiling temperature. The leaves impart their active properties to water, alcohol, proof-spirit, ether, volatile oils, and fixed oils. Proof-spirit is the menstruum used for the officinal *Tinctura hyoscyami.* It exhausts the dry leaves most effectually when used in the way of percolation. A superior tincture to the officinal forms of this preparation may be made according to the Edinburgh formula for tincture of conium, by expressing the juice of the fresh leaves, percolating the residuum with rectified spirit, mixing the two fluids, and filtering the product. The only objection to this process is, that, tincture of hyoscyamus being much in demand, the druggist would have to keep an inconvenient quantity in store from one summer to the next. When the leaves are heated with fixed oil,

they impart to it their activity, and a preparation is obtained which is officinal in some continental Pharmacopœias under the name of *Oleum coctum hyoscyami.*

The leaves and seeds have been repeatedly analyzed, and in recent times especially by Brandes, and by Geiger and Hesse,—whose results, however, do not tally. Geiger and Hesse obtained crystals from the seeds in tufts of transparent silky needles,—rather sparingly soluble in water, and freely soluble in alcohol and ether,—alkaline in action upon vegetable colours,—capable of forming neutral, and sometimes crystallizable salts with acids,—volatile, with little decomposition, if strongly heated alone, but readily decomposed, with evolution of ammonia, if boiled in contact with alkalis,—precipitable from its solutions by tincture of galls,—and possessed of a nauseous, acrid, tobacco-like taste, together with intense energy as a narcotic poison. This crystalline principle is probably the true hyoscyamia. An oleaginous substance obtained by Brandes seems to contain it in a modified form, because the poisonous action of both is the same in kind. The active principle is very prone to decomposition under the influence of heat, so long as it remains in its natural state of combination; and its destruction is always indicated by the escape of ammonia. A ready explanation is thus given of the variable strength and frequent inertness of the preparations of hyoscyamus.

The discovery of this active principle, if verified, will probably prove important in pharmacy and therapeutics. The process of Geiger and Hesse for obtaining it consists in exhausting the seeds first with rectified spirit and then with hot water,—concentrating the united liquids and purifying them by the alternate use of lime and sulphuric acid,—decomposing the product, when much concentrated, by an excess of carbonate of soda,—expressing the alkaline liquor, exhausting the residue with absolute alcohol, and agitating the alkaline liquor with sulphuric ether,—treating the united alcoholic and etherial liquors, first with lime and then with animal charcoal,—distilling off the etherized alcohol and evaporating the residuum after the addition of a little water,—and purifying the hyoscyamia thus obtained by uniting it with an acid, and repeating the whole process from the addition of carbonate of soda onwards. Henbane, it may be added, is one of the narcotic vegetables, from which a highly poisonous empyreumatised oil and distilled water may be got by destructive distillation (Morries). The fixed oil of the seeds separated by expression was once used in medicine, and is still known on the continent. It is considered to possess narcotic qualities.

Adulterations.—Hyoscyamus is not properly speaking subject to adulteration; but the dried leaves are often inert, in consequence of having been unskilfully dried or carelessly preserved. A good method of ascertaining their quality is much wanted. Geiger says

the leaves of the thorn-apple are sometimes mistaken for those of henbane by herbalists. But they have little resemblance; and the most unpractised collector may easily distinguish them by their being entirely destitute of hairs.

Actions and Uses.—This plant is usually considered narcotico-irritant in its action. Its irritant properties are obscure, being confined to the production of dryness and rawness of the throat when it is given in large doses, together with some tendency to act upon the bowels. It is on the contrary a very powerful narcotic, dangerously poisonous when taken freely, and in small doses anodyne, hypnotic, calmative, and antispasmodic. As a poison it produces, like several other solanaceous vegetables, a precursory stage of delirium, with loss of vision and dilated pupils,—and then deep, pure sopor, with excessive dilatation of the pupil,—to which in cases of recovery a second stage of delirium often succeeds. Emetics and the stomach-pump, blood-letting, stimulants, and afterwards acids, are the chief remedies in such cases. Every part of the plant is poisonous, the roots being feeblest, the seeds most energetic. The roots,—which have been the most common cause of incidental poisoning with henbane, in consequence of their resemblance, not very striking however, to parsneps,—appear almost inert early in spring, and acquire activity only when the plant is in full vegetation during the summer (Orfila). In medicinal doses hyoscyamus allays pain, soothes excitability, induces sleep, and arrests spasm; and it is much employed for these purposes, especially in Britain. Its utility as an anodyne and hypnotic has been denied by some French writers, on the authority of extensive trials made by Fouquier. But British experience is decidedly in its favour. With some people, and probably more often than opium, it occasions excitement and anxiety, headache, unpleasant dreams, spectral illusions, and delirious talking. These effects I have observed to be most frequent where a febrile state of the constitution prevails, and above all if the head be peculiarly affected. More generally however it induces soft refreshing sleep, and that too sometimes in cases where opium disagrees in all shapes. It has the peculiar advantage over opium as a habitual hypnotic, that it does not constipate the bowels, but, if any thing, even loosens them. It possesses the valuable property of preventing the tormina produced by some active cathartics, such as scammony, colocynth, and aloes, yet without impairing their energy. When applied outwardly it sometimes relieves local pains, like the allied plant belladonna; and it dilates powerfully the pupil when applied to the eye. Its special applications may be inferred from this view of its actions. It is given in a general way to obtain sleep, particularly where opium disagrees, or where constipation must be avoided,—in neuralgic affections both inwardly and outwardly,—in spasmodic diseases of all kinds,—in croup, gout, rheumatism, and other inflammations, if attended with troublesome nervous

excitability, and not with high fever,—in all forms of chronic cough, whatsoever its nature or cause,—and in most irritations of the urinary organs. It was at one time considered a deobstruent and alterative in chronic diseases of the lymphatic glands; but this opinion is obsolete. Probably the chief consumption of it now-a-days is in combination with those purgatives which cause griping, and more especially with the compound colocynth pill-mass. The Edinburgh Pharmacopœia has a preparation of this kind, the *Pilula colocynthidis et hyoscyami*, which is probably the most unerring, yet mildest, of all laxative pills, and is at present in extensive demand. Hyoscyamus has never come into use in this country as a remedy for dilating the pupil, or as a topical anodyne; but it is probably little, if at all, inferior for these purposes to belladonna. The best preparation for general use as an anodyne and hypnotic is the tincture. The chief form for combining with purgatives is the extract. For external use a poultice of the leaves may be employed, or the continental *Oleum coctum hyoscyami.*

The Hyoscyamia of Geiger and Hesse is a powerful narcotic poison. When it is applied in minute quantity to the eye it dilates the pupil excessively and for a long time, yet without impairing vision. The impure oleaginous principle of Brandes acts similarly. The empyreumatic oil is an energetic narcotic poison. The relations subsisting between the properties of these three substances and those of hyoscyamus itself have been hitherto little investigated.

The doses of the preparations of Hyoscyamus are *Extractum hyoscyami*, E. L. *Succus spissatus hyoscyami*, D. gr. v. ad scr. i. *Tinctura hyoscyami*, fl. scr. ii. ad fl. dr. ii.

INULA, *L. D.* *Root of Inula Helenium, L. W. DC. Spr.* *Elecampane.*

FOR. NAMES.—*Fren.* Aunée.—*Ital.* Elenio; Enula campana.—*Span.* and *Port.* Enula campana.—*Ger.* Grosser alant.—*Dut.* Gewoon alant.—*Swed.* Alandsrot. —*Dan.* Alandsrod; Sanct-Ellensrod —*Russ.* Deviasil.

Inula Helenium figured in Nees von E. 240.—Hayne, vi. 45.—Eng. Bot. 1546.

ELECAMPANE was the 'Ελένιον of the Greek physicians. It is now put to very little use in this country.

The plant, which belongs to the Linnæan class and order *Syngenesia superflua*, and to the Natural family *Compositæ* of Decandolle, or *Asteraceæ* of Lindley, grows on moist shady meadows in this and other European countries. It produces from a perennial root an annual stem between three and five feet tall, and bears star-like, golden-yellow flowers in July and August. The root is thick, branchy, of an aromatic odour, and at first of a glutinous taste, succeeded by aroma, bitterness, and then some acridity. As sold in the shops it consists of yellowish-white slices, mostly transverse. It contains a little volatile oil, acrid resin, gum, about 37 per cent of bitter extractive, as much of a peculiar amylaceous

principle, termed Inulin (John), and a neutral crystalline principle (Gerhardt). Inulin, discovered in 1804 by Valentine Rose, consists of globules like those of starch; but it differs from that principle in being somewhat soluble in boiling alcohol, in being precipitated in part on cooling from a boiling watery solution, and in its solution being rendered not blue, but yellow by iodine. Its constitution is identical with that of starch, $C^{12} H^{10} O^{10}$ (Mulder). It has been found in many other roots.

Elecampane is an aromatic stimulant, and in large doses emetic. It forms part of the *Confectio* or *Electuarium piperis*, but is not put now to any other use, and may be omitted without injury from that preparation.

IODINEUM, *E. L. D.* *Iodine.*

TESTS, *Edin.* Entirely vaporizable: Thirty-nine grains with nine grains of quicklime and three fluidounces of water, when heated short of ebullition, slowly form a perfect solution, which is yellowish or brownish, if the iodine be pure, but colourless, if there be above two per cent of water or other impurity.

TESTS, *Lond.* When heated it first melts and then sublimes in violet vapours. It is scarcely soluble in water, more so in alcohol. It renders starch blue.

PROCESS, *Edin.* Iodine as obtained in commerce being almost always adulterated with variable proportions of water, and being consequently unfit for making pharmaceutic preparations of fixed and uniform strength, it must be dried by being placed in a shallow basin of earthenware in a small confined space of air with ten or twelve times its weight of fresh-burnt lime, till it scarcely adheres to the inside of a dry bottle.

IODINEI TINCTURA, E. D.

PROCESS, *Edin. Dub.* Take of
Iodine, 2½ ounces (two scruples, D.);
Rectified spirit, two pints (1 ounce, D.)
Dissolve the iodine in the spirit with the aid of gentle heat and agitation; keep the tincture in well-closed bottles.

IODINEI TINCTURA COMPOSITA, L.

PROCESS, *Lond.* Take of
Iodine, an ounce;
Iodide of potassium, two ounces;
Rectified spirit, two pints.
Macerate till they be dissolved, and filter.

LIQUOR IODIDI POTASSII COMPOSITUS, L.

PROCESS, *Lond.* Take of
Iodine, five grains;
Iodide of potassium, ten grains;
Distilled water, a pint. Dissolve.

IODINEI LIQUOR COMPOSITUS, E.

PROCESS, *Edin.* Take of
Iodine, two drachms;
Iodide of potassium, an ounce;
Distilled water, sixteen fluidounces.
Dissolve the iodine and iodide in the water with gentle heat and agitation.

IODINEI UNGUENTUM, D.

PROCESS, *Dub.* Take of
Iodine, a scruple;
Prepared hog's lard, an ounce.
Triturate to form an ointment.

IODINEI UNGUENTUM, E. UNGUENTUM IODINEI COMPOSITUM, L.

PROCESS, *Edin. Lond.* Take of
Iodine, one drachm;
Iodide of potassium, two drachms;
Lard, four ounces;
(Rectified spirit, two fluidrachms, L.)
Triturate together the iodine and iodide (with the spirit, L.); add gradually the axunge and make an ointment.

FOR. NAMES.—In most continental languages—Iod.—*Ital.* Iodio. —*Fren.* Iode

IODINE was discovered in 1812 by Courtois, a French manufacturing chemist; and in 1820 its medicinal virtues were first made known by Dr Coindet, Senior, of Geneva.

Natural History.—It was first found in the mother-water of nitre, and has since been discovered in kelp and sea-weed, in sponge and other marine animals of the lower orders, in some rock salts, in sea-water, many brine springs, and some sulphureous mineral waters, and likewise in a silver ore from Mexico, as well as a zinc ore from Silesia. In all these sources but the last two, it exists in combination with the alkaline or earthy metalloids; and in the two ores it is combined with silver or with zinc. In every situation it is found only in small proportion. Its most abundant source is the mother-water of kelp, after carbonate of soda and chloride of potassium have been crystallized. It is manufactured in large quantity in Scotland from the kelp of the Hebrides and Orkney Islands. Dr Traill informs me that the greatest quantity is produced by kelp made from "drift-weed," which is in a great measure composed of *Laminaria digitata* and *Himanthalia lorea*; and that "cut-weed," which consists of *Fucus vesiculosus* and *F. serratus*, yields much less of it. One hundred tons of Caithness kelp yield, according to the experience of a manufacturer, 1000 pounds of iodine, or about a 224th part.

Chemical History.—The process by which iodine is prepared from the mother-water of kelp varies in different manufactories. A certain proportion of it is easily obtained by heating the liquid with sulphuric acid; upon which violet fumes of iodine are disengaged and may be condensed in a receiver. The quantity produced is greater if black oxide of manganese be mixed with the materials in the retort. It is said that a still larger proportion may be got by the following process suggested by Soubeiran. Sulphate of copper is added to the mother-water so long as a white precipitate of iodide of copper is thrown down. The supernatant liquor is then treated with more of the sulphate together with iron filings. The iron, taking the place of the copper in the solution, sets that metal free; and the metal, in the act of evolution, unites with what remains of the iodine in the fluid, so that more iodide of copper is formed. When this iodide is mingled with oxide of manganese and sulphuric acid, a moderate heat decomposes it, and iodine is sublimed.

It is usually sold in small scales, sometimes in solid masses, of a shining appearance and black colour. It emits a powerful odour and a vapour which strongly irritates the nostrils. It possesses an acrid taste. It is brittle and pulverizable. Its density is usually stated at 4.95, but by Dr Thomson at 3.084 only. It stains the skin brownish-yellow, and, if the contact be prolonged, will destroy the soft textures of the body. At ordinary temperatures it slowly evaporates if exposed; it readily passes over in vapour along with that of boiling water; and when heated in the dry state, it first fuses at 225°, and then at 347° boils and distils over

in the form of a beautiful violet-coloured vapour,—whence it has received its name (ἰώδης). From a state of vapour it condenses in scales; but if gently heated in the bottom of a capacious cylindrical glass vessel, it slowly shoots up from the mass below in splendid feathery crystallizations. Water dissolves only a 7000th of its own weight, and acquires a brownish-yellow colour. It dissolves in twelve parts of rectified spirit at 60°, and is very soluble in ether. The spirituous solution in its concentrated state is the officinal *Tinctura iodinei* of the Dublin and Edinburgh Colleges. According to Guibourt this preparation is unstable, part of the iodine in old specimens passing into the condition of ioduretted hydriodic acid. The strength of the tincture may be tested by shaking copper filings in it, and weighing them when dried: the increase of weight is all iodine (Herzog). It is also soluble in the volatile oils; but with some of them, especially those from coniferous vegetables, considerable heat is evolved, brisk effervescence ensues, and much of the iodine is discharged in vapour. It is much more soluble in various saline solutions than in water, and freely so in solution of iodide of potassium, forming a dark reddish-brown fluid. The London and Edinburgh Colleges have each a solution of this nature, the *Iodinei liquor compositus*, E. and the *Liquor iodidi potassii compositus*, L.—the latter of which is a very weak solution, the former a strong one. Iodine presents many interesting chemical relations which it would be out of place to detail here. It unites with oxygen and hydrogen to form acids; with sulphur, phosphorus, carbon, chlorine, &c.; and with most of the metals. With some of the metals, such as iron, mercury, and copper, it unites directly; with others only through the medium of double decomposition. When heated with the alkalis or alkaline earths in solution, iodides of the metals are formed, together with iodates of the metallic oxides; but on exposing the mixture of salts to a strong heat near redness, metallic iodides alone remain. Of its relations to organic substances, it is necessary to mention here chiefly those which it presents with starch. Starch globules are acted on by it, according to their source, either not at all or feebly, unless triturated or heated in water. Some varieties when triturated, or even strongly shaken, with cold water and iodine, become deeply purplish-black. If converted by boiling with water into soluble starch or amidin, all varieties unite with iodine, and form a blue precipitate of such intensity, that iodine may be thus detected in 450,000 parts of water (Strohmeyer). For the developement of this action it is indispensable that the iodine be free, and the liquid cool. Iodine is easily mixed with fatty substances; but the precise nature of its action with them has not been carefully examined. With lard it constitutes the *Unguentum iodinei* of the Dublin Pharmacopœia. It is apt to escape from the surface of this ointment, a result which is much impeded by uniting it with iodide of potassium, as in the ointment of the London and Edinburgh Colleges. Iodine has not

hitherto been decomposed, and is considered a simple body. Its equivalent number is 126.3.

Adulterations.—It is much subject to adulteration in consequence of its price and the great demand for it. According to my observation, it is seldom pure. Many adulterations have been indicated in chemical and pharmaceutic works, such as with oxide of manganese, charcoal, plumbago, red oxide of iron, and the like. I have never met with any of these impurities; which are obviously fraudulent admixtures, easily discoverable by the test of sublimation. A frequent adulteration however is water; of which I often found some years ago as much as between fifteen and twenty per cent. There is some difficulty in manufacturing very dry iodine on the great scale; but so large a proportion of moisture can scarcely be present from faulty manipulation alone. The adulteration is of consequence in various pharmaceutic processes for making the compounds of iodine. It may be easily detected, when great in amount, by the iodine adhering to the inside of the bottle, or even making the bottle visibly moist. The London College has not supplied any tests of the purity of iodine, the characters in the Pharmacopœia being merely distinctive. The Edinburgh formula includes two useful tests. The complete vaporization of the substance excludes all fixed impurities. The solvent action of pure lime, used as described in the Pharmacopœia, excludes all impurities whatever, amounting to more than two per cent. If 39 grains of iodine be heated with nine grains of pure lime and a few ounces of water, all but a mere trace is converted into colourless iodide of calcium and iodate of lime; but the trace unacted on is sufficient to give the solution a yellowish-brown colour. In point of fact, if a sample contain 98 per cent of real iodine, a pale brown solution is obtained. If it contain only 97.72 per cent, the solution is colourless. This very convenient process was communicated by Dr Henry Madden.

Actions and Uses.—The actions of iodine are complicated and in some measure still imperfectly understood. Much however has been already done to illustrate the subject by Coindet, Orfila, Magendie, Manson, Bardsley, Lugol, Bramley, and most recently by Dr Buchanan and Dr Cogswell. The following is a summary of their conjunct results,—so far as frequent discrepancies will permit a comparison. It appears to be, according to its dose and the manner of prescribing it, an irritant and corrosive,—a tonic, diaphoretic, and diuretic,—and to possess the property of inducing a peculiar state of the body, termed Iodism, during which it stimulates the mucous membranes, liver, and absorbent glands, excites the sexual organs, and brings on debility of the digestive functions, muscular weakness and emaciation.

In doses of a few grains it is a topical irritant, and occasions nausea, vomiting, pain in the stomach, and anorexia, with headache and giddiness. In larger doses these symptoms are increased to

the usual phenomena of irritant poisoning; one drachm or at most double that amount might occasion death; and, besides signs of inflammation in the dead body, there is usually found a number of small orange-coloured eroded spots in the mucous coat of the stomach. In very small doses iodine is on the contrary held to fortify the stomach and improve the appetite and digestion; but this statement seems doubtful. Single doses of moderate extent have been observed sometimes to produce diuresis; but this effect is precarious unless where frequent doses have been taken for a length of time, so as to occasion other symptoms of iodism. It very quickly undergoes conversion into hydriodic acid in the stomach (O'Shaughnessey). In this state it is absorbed, and is afterwards discharged with the urine; in which secretion it may commonly be found soon after being swallowed.

But the most remarkable of the effects of iodine are produced when it is taken for a long time in frequent small doses. The series of phenomena thus induced have been generally thought to be connected with a peculiar constitutional state, to which the name of Iodism has been conveniently given. When this state is developed characteristically, there is a preliminary stage of headache, giddiness, nausea, languor, loss of appetite, and inaptitude for exertion: and at length the patient is affected with complete anorexia, extreme muscular weakness and tremors, emaciation, a frequent feeble pulse, palpitation, faintness, anxiety and a sense of sinking, dinginess of the skin with clammy sweats, diuresis and priapism, bilious purging, and occasionally wasting of the mammæ or testicles. This affection may prove fatal if the iodine be not abandoned in time: but it generally recedes soon after the doses are given up. In the early stage of it a variety of interesting physiological and therapeutic phenomena are often manifested. Not unfrequently there is an increased discharge of bile; and the liver, if gorged or hypertrophied, undergoes sensible diminution. Often too the mucous membrane of the nostrils becomes inflamed, exactly as in a cold in the head. Sometimes the pulmonary mucous membrane is similarly affected. There is often diaphoresis, and occasionally an eruption of pustules. An increased discharge of urine is also not uncommon. But the most invariable phenomena are the removal of enlargement of the external glands and the stimulation of ulcers in strumous habits. Some of the effects here described, as tending to manifest themselves in the early stage of iodism, may occur before that state is fairly brought on; but they appear to be most characteristic, and to arise with the greatest certainty, contemporaneously with the first unequivocal indications of iodism,—giddiness, headache, and uneasiness in the stomach. The nature of the symptoms constituting iodism led at first to the supposition that iodine, like mercury, lead, and digitalis, is a cumulative medicine. This however now seems doubtful. At all events iodism does not increase, like mercurialism, after its cause is no longer in operation.

The risk incurred from it has been much exaggerated by some; for it may in general be easily kept under by suspending the use of the iodine, and the extreme cases of it described by the earlier observers are now never seen.

There is a great difference in different constitutions as to susceptibility of the constitutional action of iodine. Thirty drops daily of the solution of iodide of potassium and iodine have been known to occasion incipient symptoms of iodism in five days. On the contrary between two and eighteen grains of iodine have been taken daily till 953 grains were swallowed, before any signs of action appeared; and I have known it taken in the shape of tincture or compound solution continuously for fifteen months, to the extent of fifteen drops thrice a-day, on account of strumous affections, without any other result except increased appetite and some diuresis.

Considerable doubts prevail as to the influence of chemical combination on the constitutional action of iodine. In the form of iodide of potassium, its effects seem to undergo little modification, farther than that it is less energetic, less apt to disorder the stomach, more certain and more active as a diuretic, and also more disposed to excite coryza and pustular eruptions. But in the form of iodide of iron, mercury, or lead, which are all officinal compounds,—although it is held by some to retain its properties, merely united with those of the particular metal, and but slightly modified,—there is some reason to suppose that its own peculiar properties are lost to a great degree, and that these iodides act much more as compounds of their metals than as compounds of iodine (Cogswell).

It is probable that most of the effects, usually classed under the constitutional action of iodine, may be induced, through whatever channel the remedy is admitted into the animal system. At all events many of them may be attained, and among the rest the remarkable effect upon the absorbent glands and other glandular bodies, by rubbing it in the form of ointment into the skin.

Its special applications are very numerous. Though of undoubted utility in many diseases, it has been confessedly employed much too indiscriminately. It was first used by Dr Coindet in bronchocele, and has since been applied to the treatment of most chronic diseases, but especially chronic tumours, glandular obstructions, and various cachexies.——Its efficacy in bronchocele is unequivocal. Dr Manson cured 87 cases out of 120 and greatly relieved ten more; Coindet was not less successful; and Mr Bramley, while in Nepal among the Himalaya mountains and under unfavourable circumstances, cured 57 out of 116, and brought 34 more into a fair way towards ultimate recovery. It is most serviceable in the early congestive stage, or the middle stage of gelatiniform effusion; and in the final state of induration of the thyroid gland it is of little benefit. Good effects sometimes show themselves in seven or eight

days, commonly within three weeks, but often not till after five weeks of uninterrupted treatment. They are most manifest when some of the constitutional physiological phenomena mentioned above are produced. The tincture of iodine, or the *Liquor iodinei compositus*, E. is the best preparation; but it is useful to unite also friction of the tumour with an ointment. It is worthy of remark that burnt sponge, which contains iodide of sodium, and some brine springs, such as that of Salzhausen, which present an impregnation of the same salt, were long held important remedies for bronchocele before iodine was known to chemists.——In the multifarious forms of scrofula this substance is also frequently beneficial. In strumous ophthalmia, ulcers of the integuments, enlargement of the external absorbent glands, and even diseased mesenteric glands, it is generally acknowledged to possess greater virtues than any other article of the Materia Medica. Dr Manson states that in strumous ulcers and tumours, and in scrophulous ophthalmia, he found it "the most energetic medicine he ever employed;" M. Lugol received a prize of 6000 francs from the French Institute for extensive inquiries on the same subject, which led him to a similar conclusion; and iodine still continues the most favourite anti-scrophulous remedy. As it must often be given for a great length of time, there is advantage in using the iodide of potassium in these affections instead of iodine; and where external sores exist, the ointment of iodide of lead is often a useful adjunct. The approach of iodism should be carefully watched, and its symptoms checked.——Secondary syphilis is an allied affection, where iodine has seemed even more serviceable than in struma; and in the *Cachexia mercurialis* the iodide of potassium is one of the best of all remedies.——Chronic enlargement of the liver is sometimes removed by a course of iodine. Most authors on iodine have given illustrative cases; I have myself met with several; and Dr Cristin of Pavia recommends it particularly in enlarged liver and spleen originating in ague, which he has seen removed by it in ten or fifteen days.——Ovarian tumours have been reported by Dr Thomson, Dr Elliotson, and Dr Bardsley to have been repeatedly cured by it; and Dr Elliotson in particular found it, as he thought, superior to every other remedy. In some trials however I have been unable to observe any improvement, even at a rather early stage of the disease.——Leucorrhœa has been occasionally cured by it; and several observers speak well of it in amenorrhœa; but others, such as Dr Manson, could remark no effect from it in extensive trials.—Gendrin thought it serviceable in gout; in the acute forms of which he found the fit cut short nine times out of every ten trials.—Several have recommended it as a diuretic in dropsy; and Dr Bardsley thinks it a powerful remedy in those forms of ascites which occur in connexion with diseased liver. A more untractable combination of maladies does not exist, so that a new remedy is much to be desired; but I am sorry to say

that my observation does not correspond with that of Dr Bardsley. —It is said to have been, in the practice of some, a certain remedy for various scaly cutaneous diseases, such as lepra, psoriasis, and the like; but this statement is not conformable with my own observation in the Edinburgh Infirmary, where these affections are common.—Among other disorders may be merely mentioned phthisis pulmonalis, white swelling, caries, palsy, chorea, rheumatism, gonorrhœa, hernia humoralis, hydrocele, as having been experimented on occasionally with apparent success. The sanguine hopes expressed by Dr Scudamore and Sir James Murray of the utility of iodine inhalations in phthisis have not induced many to follow their example. In palsy it appears sometimes to excite headache with giddiness, and therefore to be contraindicated. Manson cured by it six-sevenths of his cases of chorea, seventy-two in number. The tincture diluted with thrice its volume of water has been generally adopted as an injection in hydrocele after removal of the effused fluid, to stimulate the tunica vaginalis to adhesive inflammation.— Iodine is held to be contraindicated in cerebral congestion and tendency to apoplexy, in menorrhagia, in disordered stomach or bowels, and wherever local diseases become attended with symptomatic fever or with incidental febrile affections.

The chief preparations of iodine for external use are the simple Iodine-ointment of the Dublin College, which contains a scruple per ounce,—the Iodine-ointment of the Edinburgh College, or Compound Iodine-ointment of that of London, which contains rather less iodine, with twice its weight of iodide of potassium,—and the Iodide of lead ointment of the two latter Colleges, containing an eighth part of iodide of lead. The second of these is the best for infriction, because it is more active than the ointment of iodide of lead, and more permanent, as well as less irritating, than the simple ointment of iodine. But the lead ointment is a good application for strumous sores and strumous ophthalmia. For internal use the preparations now employed are the simple Tincture of the Edinburgh and Dublin Colleges, which contains about one grain of iodine in about fifteen by measure of rectified spirit,—the Compound tincture of London, which contains half the iodine of the former, with twice as much iodide of potassium as of iodine,—the London Compound solution of iodide of potassium, a watery solution of a seventieth of that salt and half as much iodine,—and the Edinburgh Compound solution, a stronger solution of the same nature, containing about a sixtieth of iodine and four times as much iodide of potassium. The last form has been long in universal use. It does not appear why the London College, in acknowledging it, deviated so far from the original proportions given by Coindet, and employed generally in this country since its adoption by Dr Manson. This consists of ten grains of iodine, and thirty-six of iodide of potassium in 576 of water,—almost exactly the proportions adopted in the Edinburgh formula. The best forms for

internal use are the Compound tincture, and Compound solution. There are so many substances incompatible with iodine, that its preparations are best given in simple water, and diluted to the patient's taste.

The doses of the officinal preparations of iodine are these: *Tinctura iodinei*, E. D. min. v. ad min. xv. twice or thrice daily. *Tinctura iodinei composita*, L. min. v. ad min. xv. *Liquor iodidi potassii compositus*, L. scr. i. ad fl.dr. i. repeatedly. *Liquor iodinei compositus*, E. min. x. ad min. xv. *Unguentum iodinei*, E.; *Unguentum iodinei compositum*, L. externally, in portions of the size of a field-bean. *Unguentum iodinei*, D. the same.

IPECACUANHA, *E. L. D.* *Root of Cephaëlis Ipecacuanha, Richard, Hist. Ipec.—DC.—Spr. Ipecacuanha.*

Pilulae Ipecacuanhae Compositae, L.

Process, *Lond.* Take of
Compound ipecacuan powder, three drachms;
Squill, recently dried, and
Ammoniac, of each a drachm;
Mucilage of acacia, a sufficiency.
Beat them together into a uniform mass.

Pilulae Ipecacuanhae et Opii, L.

Process, *Edin.* Take of
Compound ipecacuan powder, three parts.
Conserve of red roses, one part.
Beat them into a proper mass, which is to be divided into four-grain pills.

Pulvis Ipecacuanhae Compositus, E. L. D.

Process, *Edin. Lond. Dub.* Take of
Ipecacuan in powder, and
Opium in powder, of each an ounce (a drachm, L. D.);
Sulphate of potash, eight ounces (an ounce, L. D.)
Triturate them together thoroughly. (Triturate the salt and opium to powder, and mix the ipecacuan, D.)

Syrupus Ipecacuanhae, E.

Process, *Edin.* Take of
Ipecacuan in coarse powder, 4 ounces;
Rectified spirit, a pint;
Proof-spirit, and
Water, of each fourteen fluidounces;
Syrup, seven pints.
Digest the ipecacuan in fifteen fluidounces of the rectified spirit at a gentle heat for twenty-four hours; strain, squeeze the residue, and filter. Repeat this process with the residue and proof-spirit, and again with the water. Unite the fluids and distil off the spirit, till the residuum amount to twelve ounces. Add to the residuum five fluidounces of the rectified spirit, and then the syrup.

Vinum Ipecacuanhae, E. L. D.

Process, *Edin. Lond. Dub.* Take of
Ipecacuan in moderately fine powder, two ounces and a-half (two ounces, D.);
Sherry, two pints (old-wine m. D.)
Macerate for seven (fourteen, L.) days, and filter.

For. Names.—*Fren.* Ipecacuana.—*Ital.* Ipecaquana —*Span.* and *Port.* Ipecacuanha.—*Ger.* Brechwurzel; Ipecacuanha.—*Dut.* Ipecacuanna.—*Swed.* Kräkrot.—*Dan.* Americansk Bräkrod.—*Russ.* Rvotnoi koren.

Figures of Cephaëlis Ipecacuanha in Nees von E. 258—Hayne, viii. 20.—Roque, 97.—Linn. Trans. vi. 11.—Steph. and Ch. ii. 62.

Ipecacuan was first distinctly described in 1648 by Piso and Marcgrav in their Natural History of Brazil, as a remedy much prized in that country for a variety of therapeutic purposes. It first came into use in Europe about thirty years afterwards, in consequence of successful experiments made with it at Paris by John

Helvetius, both in the hospitals, and on the persons of the Dauphin and many of the French noblesse (Sprengel).

Natural History.—Although both Piso and his fellow-traveller Marcgrav gave a tolerably good description of two ipecacuan plants and a rude figure of one of them (Piso, p. 101, Marcgrav, p. 17), the botanical source of the ipecacuan of commerce was not correctly ascertained till a recent date. Piso mentions a white and a brown variety of the drug, the latter of which is officinal ipecacuan; and he describes two distinct plants as their sources. Linnæus assigned the ipecacuan of European commerce to a species of *Viola;* and his son, in consequence of a mistake of Mutis, referred it in 1781 to a species of *Psychotria* inhabiting Peru,—a statement which was more lately revived on the authority of Humboldt, although no officinal ipecacuan comes from any part of South-America except Brazil. In 1801 Gomez of Lisbon first gave an accurate scientific account of the Brazilian plant; and next year his countryman Brotero republished his description, without acknowledgement, in the Linnæan Transactions of London, and called the plant *Callicocca Ipecacuanha.* This name was afterwards altered by Tussac to *Cephaëlis Ipecacuanha*, now generally adopted by botanists. The later botanical inquires of Tussac, Richard, Martius, Mérat, and St Hilaire have fully tested the accuracy of the reference of Gomez.

The true ipecacuan plant belongs to the Linnæan class and order *Pentandria Monogynia,* and to the Natural family *Rubiaceæ* of Decandolle, or *Cinchonaceæ* of Lindley. It inhabits moist shady woods in Pernambuco, Bahia, Rio Janeiro, San Paulo, and other provinces of Brazil. It is also said to occur in New Granada (Humboldt) and in some of the West-Indian islands (Labat). It is perennial. It has an inclined almost creeping stem, with several upright branches between six and twelve inches high, and crowned with from four to eight leaves,—and several contorted, knotty, ringed roots, towards six inches long, and about the thickness of a goose-quill. It flowers between November and March. The root, its officinal part, is gathered throughout the whole year; and hence, as no regard is paid to securing its propagation by seed, the plant is becoming scarce near the coast.

Ipecacuan as imported into this country consists of the proper knotty root, the thinner, ligneous, cylindrical attachment by which it is connected with the stem, and often a portion of the trailing part of the stem also. The ringed root-proper is the most active part, and ought to be alone used by the druggist. It is from two to seven inches long, as thick as a goose-quill in the middle, tapering towards both ends, contorted, and traversed by many deep annular grooves, not parallel, which impart to it a characteristic, irregularly jointed, or knotty appearance. It consists of a thick bark and slender meditullium or woody part. The bark is externally grayish-red or dark brownish-red (grayish-black, Guibourt,) inter-

ally gray, horny and translucent, or in inferior specimens opaque, hard, brittle, and with difficulty reduced to powder. The powder is grayish-yellow. It has a faint, bitterish, obscurely acrid taste, and a weak, musty, peculiar odour, which becomes strong and nauseating during pulverization. The inner or woody part is slender, uniform and smooth, flexible, tough, woody, white, feeble in odour as well as taste, and comparatively inactive. The bark is easily detached from the wood by friction, and consequently in damaged samples is often in part wanting. It is worthy of remark that the fresh root is said to have a more acrid taste and a much stronger odour; and that its officinal designation is derived from one of its aboriginal names in Brazil which has reference to the latter of its sensible properties. It appears nevertheless, that its most familiar American name is not ipecacuanha, as was commonly thought from the days of Piso, but *Poaya do mato*,—the term Poaya being applied by the aborigines of Brazil to emetic roots in general. Pharmacologists have divided the true ipecacuan-root into several varieties, and Guibourt makes no fewer than three, the grayish-black, grayish-red, and grayish-white ipecacuan, which are so termed from the relative colour of their surface. But although these varieties are thought to differ somewhat in strength, the darkest being probably the most active, their differences are scarcely so material as to warrant their separation, and are owing in all likelihood to mere varieties in soil, age, the season of collection, or the manner of drying the root (Geiger). The dark brown kind is one of Piso's two sorts, his Ipecacoanha *fusci coloris*.

Chemical History.—Ipecacuan yields its active properties to water, and still better to alcohol, pure or diluted. The stronger wines, such as sherry, or a spirit of equal strength, are also convenient solvents; and hence sherry is usually employed for making the officinal *Vinum ipecacuanhæ*. Boiling water takes up 40 per cent, proof-spirit 32.5, and alcohol 20 per cent of the root (Paris). In making the *Syrupus ipecacuanhæ* the Edinburgh College directs rectified spirit, proof-spirit, and water to be used in succession, so as to dissolve thoroughly every soluble principle. But this elaborate formula, adopted from one proposed lately by Jeromel, seems unnecessarily complex; and a syrup from the simple alcoholic extract, as directed by the last Parisian Codex, is probably quite as good. The other officinal preparations being merely mechanical mixtures, they will be noticed along with the directions for prescribing the drug.

The analysis of ipecacuan was first successfully performed in 1817 by Pelletier; who found the cortical part of the dark-brown variety to consist of 2 per cent of odoriferous concrete oil, 6 of wax, 10 gum, 42 starch, 20 lignin, and 16 of a hard, brown, semitranslucent, deliquescent extract, possessing alkaline relations, and concentrating in itself the whole activity of the crude drug. The red variety he found to contain more lignin and gum, no wax, less

starch, and 14 per cent of active extract. The inner woody part of the former kind contained about one per cent only of this extract, with little gum or starch, but 67 of ligneous fibre. On subsequently reviewing his analysis, he satisfied himself that his supposed active principle, which he called Emetin, was impure; and that the root contains only about one per cent of a pure, uncrystallizable, white alkaloid, the Emeta or Emetine of chemists. The process for it, as improved by Pelletier and Dumas, consists in removing the odoriferous oil from the powder with ether, exhausting the residue with boiling rectified spirit, distilling off the spirit after the addition of a little water, boiling the filtered liquor with magnesia, washing the precipitate with cold water, exhausting it when dry with boiling rectified spirit, distilling off the spirit, combining the residue with a very diluted acid, decolorizing the solution with animal charcoal, and then repeating the process from the decomposition with magnesia onwards. Emeta is white or pale yellowish, permanent in the air, uncrystallizable, without odour and nearly tasteless, fusible about 120°, decidedly alkaline, sparingly soluble in water, even less so in ether, and very soluble in alcohol or rectified spirit. It forms with acids neutral, soluble, bitter, acrid, and for the most part uncrystallizable salts, whose solutions are precipitated by tincture of galls, and not, if pure, by diacetate of lead. From the analysis of Pelletier and Caventou, it is supposed to consist of 35 equivalents of carbon, 25 of hydrogen, 9 of oxygen, and 1 of azote ($C^{35}H^{25}H^{9}N$).

Adulterations,—Ipecacuan is generally supposed to be often adulterated. Looking to its price in the market, this may be expected to be the case with the powder. But the entire root presents characters so precise and peculiar, that no experienced person ought to be imposed on by any of the spurious or counterfeit articles hitherto known. Many spurious ipecacuans have been described by British, and still more by continental, pharmacologists; but they are little known in the trade of this country. They are chiefly the following. 1. Striated, or Black Ipecacuan, produced in Peru by the *Psychotria emetica* (Humb.—Willd.), and which was thought by the younger Linnæus to be the source of true ipecacuan, is sometimes imported into the continent of Europe, and confounded with the dark qualities of the genuine root. It is easily known however by its longer joints, which are about half an inch in length, its longitudinally striated surface, and the colour both of its epidermis and interior, which are grayish-red when recent, but dark grayish-black when old, especially if moistened. It appears to be not a bad emetic, and is employed as such in its native country. It has been analyzed by Pelletier, who found nine per cent of an emetic extract, similar to the impure emetine he first got from brown ipecacuan.—2. White, or Amylaceous Ipecacuan, produced by *Richardsonia braziliensis*, Virey,—Hayne (*R. scabra*, Martius,—Nees von E. *Richardia scabra*, Willd.) which inhabits open plains in the

Brazilian provinces of Rio Janeiro and Minas Geraës,—is one of the varieties mentioned by Piso under the name of Ipecacoanha blanca; and the plant is probably the one rudely figured both by himself and his associate Marcgrav. It was at one time common in commerce (Geiger), but seldom occurs now. Of all the spurious ipecacuans it is the one which most resembles the true root. But it may be distinguished by its annular fissures being fewer and shallower, the joints longer, the epidermis pale grayish, or yellowish-white, the substance of its bark very pale grayish-white, opaque, amylaceous, and friable, its woody centre proportionally much thicker than in the true root, and its taste obscurely acrid, without bitterness. It contains a large quantity of starch and five or six per cent of an emetic extract like impure emetine (Pelletier). It is the *Poaya do campo* of the natives of Brazil.—3. Another emetic root, sometimes called White, but more correctly Woody Ipecacuan, is produced in Brazil by the *Ionidium* (*Viola*, L. *Solea*, Spr.) *Ipecacuanha;* which was supposed by Linnæus to be the source of the true drug. This sort, now rare in European commerce, is distinguished by its greater thickness, sometimes equalling that of the little finger, by the presence of only a few transverse fissures, without distinct joints or knots, by the thinness and amylaceous appearance of its bark, and by the thickness of its woody interior. Pelletier, who, according to Guibourt, analyzed this root for true white ipecacuan, found in it 35 per cent of gum and about 5 of emetic extract, similar to impure emetine.—4. Under the title of Spurious ipecacuans Guibourt describes many other emetic roots, chiefly from the Natural families *Violaceæ* and *Apocynaceæ*, which are either used in different parts of the world for the same purposes with the true drug, or are even occasionally substituted for it in continental commerce. These are derived from the *Ionidium parviflorum* of Brazil, the *I. Itoubea* of Cayenne, *Euphorbia Ipecacuanha* of North-America, *Cynanchum vomitorium* of the Mauritius, and *Asclepias curassavica* of the West-Indian islands. *Ionidium parviflorum* (*I. microphyllum*, Humb.—Dec.) produces in Columbia the Cuichunchully de Cuença, lately described as a powerful emetico-purgative root, much esteemed in the province of Venezuela as a remedy for elephantiasis (Farre, Med. Bot. Trans. 1840).

Actions and Uses.—The actions of Ipecacuan are complex and in some measure not yet well settled. Its most familiar effects are stimulant or irritant, by virtue of which it is emetic, cathartic, expectorant and diaphoretic; and through means of its emetic and diaphoretic properties it is a sedative. It is probably also a narcotic. It is supposed to be in large doses a narcotico-acrid poison; for, though narcotic effects have not yet been observed in man even from such large doses as half an ounce, because it is promptly discharged by vomiting,—its alkaloid introduced into a wound, a vein, or the stomach of a dog in doses of two grains, excites first vomit-

ing, and then pure coma, which ends fatally in fifteen or twenty-four hours (Magendie). In the dose of a scruple, ipecacuan is a powerful emetic. It possesses certain peculiarities as such; for it seldom operates till after fifteen or twenty minutes, but at last produces repeated effectual vomiting, with much nausea, prolonged muscular straining, and copious secretion of mucus from the gullet and stomach; nor, notwithstanding the force of its action, does it ever act injuriously as an irritant even in larger doses. Hènce it is preferred to other emetics in all circumstances where a severe succussion of the system is desired, as for arresting incipient febrile diseases. But in point of certainty and speed it is inferior to some emetics, such as sulphate of zinc or sulphate of copper, which are therefore preferred in poisoning with narcotics. When emetic doses of ipecacuan fail to excite vomiting, they generally act on the bowels, and induce a mild diarrhœa. But this is not invariable; and on the contrary, when vomiting is produced, the bowels are rather constipated,—whence some ascribe to it a secondary astringent or sedative action.—In less doses, varying from one to five grains, it may produce a considerable variety of effects. The most remarkable of these is nausea. This may be kept up by successive doses for a long time, without vomiting being superinduced. It is attended with much depression of the pulse, a sense of langour, and generally perspiration, as well as increased secretion from the stomach, gullet, and lungs.—The pulmonary mucous membrane would seem to be also often stimulated to increased secretion by repeated small doses, although nausea be not produced,—probably in consequence of the lungs sympathizing with a gentle stimulus and increased secretion of the gastric mucous membrane. Hence ipecacuan is considered an expectorant, and is indeed much esteemed as such. At the same time, expectoration is never so unequivocally augmented as when nausea is also excited. Some however conceive that this stimulant action on the lungs is direct and peculiar,—founding their opinion on the fact stated by Magendie, that a more intense action, of the nature of inflammation, is observed in the lungs of animals poisoned by emeta.—The action of ipecacuan on the skin is somewhat similarly circumstanced with its influence upon the lungs. It is considered a diaphoretic, independently of its nauseating action; but it acts as such with most certainty in concurrence with nausea. Its certainty however as a diaphoretic is much increased, and its influence greatly prolonged, by combining it with opium. This combination produces copious protracted sweating, and is indeed the most powerful and sure sudorific in the Materia Medica. The effect of ipecacuan and opium on the skin does not bear any relation to nausea, though that symptom is occasionally produced at first. The opium in fact diminishes the emetic and nauseating action of the ipecacuan; which, it is remarkable, diminishes reciprocally the narcotic action of the opium.—Ipecacuan may be regarded as a

sedative in various points of view. It may act promptly and powerfully as a sedative through the medium of nausea. It may do so more slowly through the intervention of diaphoresis. Some late observations on its influence in Indian dysentery even tend to show that in frequent doses it may act directly as a sedative, reducing the pulse and allaying local inflammation, without exciting necessarily any of its usual physiological phenomena (Madras Med. Reports, 1831).—Another, but doubtful, action is that which it is supposed by some to exert in very small doses as a tonic. In the small dose of half a grain, it is said to increase the appetite, as well as to improve digestion; so that some physicians even use it as a stomachic.—A singular effect in some peculiar constitutions is, that the dust of its powder, or even its odour, produces a paroxysm somewhat like that of spasmodic asthma, attended with excessive anxiety and sometimes a tendency to convulsions.

The special therapeutic applications of ipecacuan are so numerous, that it is impossible to state them all in detail here. The following are among the most interesting or important of them. As an emetic, it is given in ague at the approach of the fit, to prevent its development; and the disease itself is sometimes altogether arrested. In like manner continued fevers of various kinds, especially if connected with derangement of the stomach, and above all in the instance of children, are sometimes checked at the commencement by free vomiting with ipecacuan. True infectious typhus however seems beyond its influence. The fit of asthma and that of hysteria are also sometimes put an end to suddenly by an ipecacuan emetic; and the fit of hooping-cough is often resolved by vomiting, induced by frequent nauseating doses aided by the natural effects of coughing. As a sudorific along with opium, it is of great service in some febrile inflammations. Inflammatory sore-throat may be often cut short if sweating be thus induced at the outset: febrile catarrh is similarly circumstanced: dysentery may be also often cured by this remedy alone: and acute rheumatism may be generally treated in the same way with great success, if free blood-letting be practised in the early stage, immediately before the sudorific is administered. Sweating by means of ipecacuan and opium is farther sometimes of service in chronic cutaneous diseases, especially of the scaly kind; and ipecacuan alone, in small doses as a diaphoretic, is thought by many to prove often beneficial. Diaphoretic doses of ipecacuan singly are also often given in chronic visceral diseases, more especially of the kidneys, and likewise in general dropsy. Its applications as a nauseant sedative to the treatment of acute local inflammations are probably extensive; but tartar-emetic has of late displaced it for these purposes. Late trials show, that it is of great service in frequent nauseating doses in the bad forms of dysentery which prevail in the East Indies. It is there given in the dose of five grains every two hours or even hourly; and nausea is the immediate object held in

view by some. By others it is thought to act, independently of nausea, as a direct sedative or contro-stimulant,—a view of its action which approaches an older doctrine, still held by a few, that it acts in this disease as a specific sedative. Dysentery was the principal disease for which Piso and Marcgrav found it in use among the natives of Brazil. The utility of ipecacuan is not confined to acute dysentery, but extends also to its chronic form as well as chronic diarrhœa; in which, though sometimes held to operate as an astringent, it acts more probably through its influence on the skin. Another of the acute local inflammations, in which it has been much lauded when given as a nauseant and even emetic, is peritonitis, especially the worst form occurring in puerperal women (Doublet, Desormeaux); and although its utility here has not been generally acknowledged, its action deserves more inquiry than it has yet met with. The last of its special applications as a nauseant that deserves mention is for the arrestment of hæmorrhage, in which some place great confidence in it. It may be used in catarrh with various views,—first along with opium as a sudorific in the early stage of the acute form of the disease, secondly alone as an expectorant in the more advanced stage, and lastly in chronic catarrh, partly as an expectorant, but chiefly as an astringent tending to diminish and inspissate the discharge.

Ipecacuan is best given as an emetic to adults in the form of powder mixed simply with water; and it is usual to add a grain of tartar-emetic to it. When the sickness begins, the emetic action may be promoted by copious draughts of warm water. To young children it is more easily given as an emetic in the form of wine, or, still better, of syrup. It is worthy of observation that vegetable acids have been said to weaken its emetic action, and acetic acid to render it merely a mild laxative (Irvine); but this statement requires confirmation. The wine is the best form for giving it as a diaphoretic when opium is not conjoined with it. Where brisk diaphoresis or a sudorific effect is desired, the best preparation is the *Pulvis ipecacuanhæ compositus.* This compound, which consists of equal parts of opium and ipecacuan, with sulphate of potash to facilitate their thorough trituration and mixture, is equivalent to the celebrated nostrum called Dover's-powder. The surest way to administer it is in three doses of ten grains each, at intervals of half an hour,—the patient being wrapped in blankets, and prevented from drinking for some time as a precaution against vomiting. The sweating, when once begun, should be kept up by warm demulcent drinks. Dr Duncan thought the quantity of ipecacuan in this preparation might be advantageously doubled. The *Pilula ipecacuanhæ et opii*, E. may be substituted for the powder, with which it is almost identical. As an expectorant it is usually given in the form of wine, and in small doses; but larger nauseating doses are more effectual. As an inspissating expectorant in chronic catarrh its best form is the Edinburgh *Trochiscus mor-*

phiæ et ipecacuanhæ described under the head of opium.——Emetine has been introduced into continental practice, but has never come into use in this country; nor does it seem to possess any advantage over the crude drug. A sixteenth of a grain will occasionally excite vomiting.

The preparations of ipecacuan, with their doses, are as follows: *Pulvis ipecacuanhæ*, scr. i. ad dr. ss. as an emetic; gr. i. ad gr. vii. for other purposes. *Vinum ipecacuanhæ*, fl.dr. iv. as an emetic; min. x. ad. min. lx. for other purposes. *Syrupus ipecacuanhæ*, E. fl. unc. ii. as an emetic for an adult; fl.dr. ii. ad fl.dr. iv. for other purposes. *Pulvis ipecacuanhæ compositus*, gr. x. ad gr. xxx. as a sudorific. *Pilulæ ipecacuanhæ et opii*, E. iii. ad viii. as a diaphoretic and sudorific. *Pilulæ ipecacuanhæ compositæ*, L. gr. xv. ad gr. xxx. as a diaphoretic.

JALAPA. *Root of Ipomœa Purga, Nees von E. Plant. Med.—Hayne's Darstellung, &c.—Jalap (Edin.)—Root of Ipomœa Jalapa, Don, MS. (Lond.)—Root of Convolvulus Jalapa, Willd. (Dub.)*

Extractum *sive* Resina Jalapae, E.

Process, *Edin.* Take any convenient quantity of Jalap in moderately fine powder; mix it thoroughly with enough of rectified spirit to moisten it well; put it twelve hours into a percolator, and exhaust the powder with rectified spirit; distil off the greater part of the spirit and concentrate the residuum over the vapour-bath to a due consistence.

Extractum Jalapae, L. D.

Process, *Lond. Dub.* Take of
Powder of jalap, two pounds and a-half (one pound, D.)
Rectified spirit, a gallon (four old wine pints, D.)
Distilled water, two gallons (Water, a gallon, D.)
Macerate the jalap in the spirit for four days and pour off the tincture. Boil the residue in the water down to half a gallon (two pints, D.) Filter the fluids separately, evaporate the decoction and distil the tincture till they thicken. Mix the extract and resin, and evaporate (in the vapour-bath, D.) to the due consistence.
This extract is kept soft for pills and hard for powders, L.

Pulvis Jalapae Compositus.

Process, *Edin. Dub.* Take of
Jalap-powder, an ounce (half a pound, D.)
Bitartrate of potash, two ounces (a pound, D.)
Triturate them to a very fine powder.

Process, *Lond.* Take of
Jalap, three ounces;
Bitartrate of potash, six ounces;
Ginger, two drachms.
Reduce them separately to powder, and mix them.

Tinctura Jalapae.

Process, *Edin.* Take of
Jalap, in moderately fine powder, seven ounces;
Proof-spirit, two pints.
This tincture may be prepared either by percolation or digestion as directed for Tincture of Capsicum.

Process, *Lond. Dub.* Take of
Jalap in powder, ten (coarsely powdered, eight, D.) ounces;
Proof-spirit, two pints (old wine measure, D.)
Macerate for fourteen (seven, D.) days and strain.

For. Names.—*Fren.* Jalap.—*Ital.* Sciarappa. -*Span.* Jalapa.—*Port.* Jalappa. —*Ger.* and *Dut.* Jalappe.—*Swed.* Jalapparot.—*Dan.* Jalap.—*Russ.* Ialapni koren ; Ialapa ; Bionok.

Figures of Ipomæa Purga in Hayne, xii. 33, 34,—Nees von E. Suppl. 51,— as Ipomæa Jalapa by Coxe in Amer. Jour. of Med. Sc. 1830,—as Exogonium Purga, by Balfour in Curtis's Botan. Mag. tab. 4280.

Ipomæa Jalapa figured in Hayne, viii. 37,—Nees von E. 197, 198,—as Convolvulus Jalapa in Roque, 70,—Steph. and Ch. i. 46.

Jalap was first introduced into Europe from America in 1609 through English commerce, and not long afterwards it was known among the Marseillese traders by the name of Gelapa (Casp. Bauhin). The officinal name is derived from Jalapa, a town in Mexico, in the neighbourhood of which it is now ascertained, that the whole jalap of commerce is produced.

Natural History.—Its botanical history, long misunderstood, has been fixed only a few years ago. After sundry conjectures by pharmacological botanists, all of them very wide of the mark, it was erroneously referred by Linnæus to a species of *Mirabilis*; but ere long he found reason to alter his opinion, and assigned it to a new species of *Convolvulus*, which he called *C. Jalapa.* Such continued to be long the received doctrine; and it seemed sufficiently warranted by the information communicated from America, first by Houston in 1734 to Jussieu and Linnæus,—then by Thierry in 1777, who saw what was pointed out to him as the true plant growing near Vera Cruz, whence the drug is exported to Europe,—and lastly by Michaux in 1788, who found the same plant in Florida, Georgia, and Carolina, cultivated it successfully at Charlestown, and sent living specimens to Paris. This plant, under the several names of *Convolvulus Jalapa*, L. Willd. *Ipomæa Jalapa*, Desfontaines,—Pursh, and *Ipomæa macrorhiza*, Michaux, was accordingly to be met with in most botanic gardens as the true jalap-plant. But so recently as 1830, it has been almost simultaneously proved through three unconnected sources, that jalap is produced by a similar yet different plant, inhabiting a totally different district from the other. Between 1827 and 1829, Ledanois, a French druggist at Orizaba in Mexico, sent the true root to Paris. Dr Coxe of Philadelphia obtained living roots from a countryman of his own resident at Jalapa. And the botanical traveller Schiede transmitted to Germany specimens and living roots from plants which he found growing in the vicinity of the same city. The true jalap-plant is consequently now cultivated in various parts of the United States and of Germany, and proves to be an entirely new species. In this country it was first successfully cultivated in the Edinburgh Botanic Garden in 1838, from a germinating root sent to me by Dr Rodgers of New York. Since then, Mr Macnab has successfully propagated it by slips from a specimen of great beauty, the root of which was obtained from the Chelsea Botanic Garden. Dr Graham determined the identity

of the first specimen with the plants described by late American, German, and French authorities, and its distinction from what had long been cultivated in the Botanic Garden stoves as the jalap plant; and the specimen raised from a slip has been subsequently described and figured by Dr Balfour. From the botanical investigations of Coxe and of Smith in America, of Wenderoth, Hayne, and Nees von Esenbeck in Germany, of Pelletan in France, and of Balfour in this country, it appears that, besides other less prominent characters, the new plant is distinguished from the old one by the stem being without down,—by the leaves also being quite smooth, less rugous, not sinuous on the edge, more acuminated, and with more tendency to pass from the cordate into the hastate form,—and above all by its stamens projecting beyond the long tube of the corolla. It has been successively regarded as a Convolvulus, an Ipomæa, and more recently an Exogonium, with which genus of Choisy it is entitled to rank in virtue of its exserted stamens. Its latest designation is *Exogonium Purga* (Bentham), previously to which it has borne the various names of *Ipomæa Purga*, Nees von E. —Hayne.—*Convolvulus Jalapa*, Schiede.—*C. Purga*, Wenderoth. —*C. officinalis*, Pelletan.—*Ipomæa Jalapa*, Nuttal and Coxe, and *Ipomæa Schiedeana*, Zuccarini. The specific name Purga is appropriately taken from the commercial designation of the drug in Mexico. The plant belongs to the Linnæan class and order *Pentandria Monogynia*, and to the Natural family *Convolvulaceæ*. Schiede found it on the mountainous land around Chiconquiaco not far from Jalapa, on the eastern slope of the Mexican Andes, at an elevation of about six thousand feet. The climate is exceedingly rainy, and the site within the line of frost in winter. It is a beautiful climber, about twelve (twenty, Coxe), feet long, which entwines shrubs and small trees in the deep forest-shades. It has a perennial root, which produces several annual stems, bearing in August and September numerous splendid scarlet (Nees von E.), crimson (Hayne), lilac (Coxe), purplish-red (Balfour), or rose-coloured (Ledanois) flowers. In Germany it has been found to thrive in the open air and to withstand the winter's cold; but it does not flower till October. In Edinburgh it flowers luxuriantly in September in a cold frame; but the root-stock is apt to be killed by severe frost. The root is gathered at all seasons, but chiefly in March and April, when the young shoots are appearing. It consists of a roundish, tuberous-like root-stock, with several root-fibres. It is black externally, but white and milky within, and varies in size, according to its age, from that of a walnut to that of a moderate sized turnip. It is dried in net-bags over the fire, sometimes entire, sometimes in sections; and is sent under the name of Purga di Jalapa to Vera Cruz, whence it reaches Europe in part directly, and in part through the medium of New York. ——Considering that the sources, from which most of these botanical statements are taken, had been before the public before 1836,

it is surprising that at that date the London College should refer to an unpublished MS. as its botanical authority for the source of the drug. The reference of the Dublin College is obsolete.

Chemical History.—Jalap is imported in roundish or pear-shaped masses, seldom so large as the fist, entire, or in halves, quarters, or thick slices,—ponderous and hard,—dark-brown, rough, and wrinkled externally,—tough, if moist, rather brittle when quite dry, —internally, grayish-brown and formed of irregular concentric layers presenting brilliant lines and points,—of a faint disagreeable odour, increased by rubbing or powdering it,—and of a nauseous, sweetish, but afterwards acrid taste. It is apt to be attacked by insects; which, however, leave its active part untouched, rendering it consequently more energetic. It is not easily reduced to powder; but the process is facilitated, as well as the fineness of the powder increased, by triturating it with some hard salt such as bitartrate of potash, or with sugar of milk. The former is used for preparing the *Pulvis jalapæ compositus* of the Pharmacopœias. The pure powder is of a pale grayish-brown colour. The common solvents act variously on jalap. Water takes up chiefly an amylaceous and mucilaginous extractive matter, and little of its cathartic principle. Alcohol or rectified spirit on the other hand dissolves chiefly a resin, to which alone are attached its purgative properties. The Edinburgh College, following the Parisian Codex, adopts the latter solvent for preparing the *Extractum*, or more properly the *Resina jalapæ*; while the two other Colleges, assuming erroneously that the other principles contribute to the action of the crude drug, still adopt the old troublesome process, by directing a true extract to be prepared through means first of spirit and then of water, the products of which are mixed together before being completely evaporated. Jalap that has been attacked by insects should be preferred for the Edinburgh process, as it contains most resin. Jalap resin may be got pure by the aid of animal charcoal, which may be mixed with the jalap powder, and the resin extracted by percolation with rectified spirit (Mouchon)—by which process twelve and a half per cent of pure resin may be obtained. But the pure resin has no medicinal superiority; and as a good deal of it is absorbed by the animal charcoal, the ordinary process of the Edinburgh Pharmacopœia and Paris Codex is to be preferred (Soubeiran). Proof-spirit, like rectified spirit, dissolves the resin of jalap readily, but along with it a small proportion of the other principles that are soluble in water; and it is accordingly used by all the Colleges for the officinal *Tinctura jalapæ*. This preparation is best made by the process of percolation. Commercial jalap has been analyzed by Henry, by Cadet de Gassicourt, by Gerber, by Marquart, and by Guibourt. They obtained from 9 to 18.5 per cent of resin, consisting, according to Cadet as well as Gerber, of a hard resin soluble

only in rectified spirit or alcohol, and a soft resin soluble in ether also,—together with variable proportions of coloured gummy extract, starch and albumen, lignin, and numerous salts,—and according to Gerber and to Guibourt, uncrystallizable sugar. In the fresh roots grown in Germany from Schiede's specimens Widnmann obtained only eleven per cent of solid matter, the rest being merely water; and from the dry roots he got 14 per cent of watery extract, 11 glutinoid matter, 34 lignin, 2 mannite, and 23 resin. Marquart, however, an accurate experimentalist, got only half that proportion of resin, being a mere trifle less than he obtained at the same time from commercial jalap. Commercial jalap that has been attacked by insects gives 14 per cent according to Henri. The resin of commercial jalap is grayish or brownish-yellow and nearly opaque, that from Schiede's roots amber-coloured and translucent. As got from either source, it is brittle and easily pulverisable, without odour, but of an acrid taste, not miscible with milk, easily soluble in alcohol, but not in ether, readily in nitric or acetic acid, readily too in solution of potash, scarcely at all in the oils, fixed or volatile (Marquart). It concentrates in itself the cathartic properties of the root. Not long ago, a statement was made that these properties had been traced to a crystalline alkaloid (Hume). But this announcement has never been verified; and it seems probable that the observer had been misled either by some coloured salt with an inorganic base, or by the resin assuming the crystalline form (Geiger).

Adulterations.—The jalap of this country is little subject to adulteration. The best qualities of the root are those which are compact, ponderous, dry, dark, and traversed by many shining lines and points. It is by no means always inferior, as Dr Duncan has stated, when worm-eaten; but such roots ought to be set apart for preparing the resin, because they are more active than the sound ones. Continental and domestic pharmacologists have described many spurious or counterfeit jalaps, among which the following are the most remarkable. 1. It is supposed that the smaller roots of *Ipomæa Jalapa* (Desfontaines,—not Don MS. of Lond. Pharm. *I. macrorhiza* of Michaux) may constitute one variety. This species, it has been already observed, was long thought to produce true jalap. It is probably purgative; which some, however, deny (Elliot). Although it grows abundantly in the hot plains around Vera Cruz, through which the true drug passes in the first instance into European trade, there is no good evidence of its root being now a commercial article. It attains an enormous size; specimens from ten to twenty-five pounds in weight being not uncommon, and some having been found to weigh fifty pounds. Murray describes it as occurring in trade in his time, forming slices about an inch in diameter, compact, gray externally, and whitish within (App. Medic.) The plant is one of the most splendid

climbing ornaments of our stoves. It is well figured in Hayne, xiii. 37, in Nees von E. 197, 198, and as *Convolvolus Jalapa*, the source of true jalap, in Steph. and Ch. i. 46.—2. A variety of jalap, known for some time in European trade under the name of Light jalap (Jalapa fibrosa, Geiger—Jalap fusiforme, Guibourt), and in Mexico by that of Purga macho or Male jalap, has been lately referred by Pelletan, from information communicated by Ledanois, to a new species, the *Ipomœa Orizabensis*, a native of Orizaba in the Mexican province of Oaxaca. The plant is figured by Pelletan in the Journal de Chimie Médicale, x. The root is spindle-shaped and towards twenty inches long. It is met with in the commerce of the United States, of France, and sometimes of Germany,—occasionally alone, but at other times mixed with true jalap. It occurs in gray-coloured slices about two or three inches broad, or in rather long, crooked, blackish pieces, as thick as the finger; both of which are internally paler, very fibrous, lighter than true jalap, but of a similar, though rather weaker, taste and smell. It is referred erroneously by Nees von Esenbeck to *Ipomœa Jalapa* (Ann. der Phar.). It contains according to Ledanois 8 per cent of purgative resin, 25.6 of gummy extract, 3.2 starch, 2.4 albumen, and 58 lignin, with some moisture. But Marquart says he got no less than 19.5 per cent of resin from it. This resin, unlike that of *Ipomœa Purga*, is very soluble in ether, partially so in oil of turpentine, and miscible by trituration with milk so as to form a smooth emulsion. In France 36 grains of the root were found equal to 20 of officinal jalap; and in Germany it has been ascertained, that its resin produces in the same doses precisely the same effects in kind and degree with common jalap-resin (Nees von E. and Marquart). Hence this variety can scarcely be regarded as spurious, and it may serve excellently for preparing the resin, as it is cheaper than common jalap.—3. 4. 5. Guibourt describes three spurious jalaps as occasionally occurring in French trade,—one probably from *Mirabilis Jalapa*, which was once thought the source of the true drug,—another from some monocotyledonous plant, probably a species of *Smilax*,—and more recently a third, of unknown source, in ovoid tubers, pointed at both ends, and of a rose-like odour. The first is easily known by a fresh-sawn surface being almost black; the second by its presenting radiated as well as concentric lines, and by its not containing any starch, so that its decoction is not turned blue by tincture of iodine; the third by its form and odour. 6. It is said that the root of *Bryonia alba*, indigenous in England as well as the continent of Europe, is sometimes sliced and mixed with jalap (Duncan). This is a very crude adulteration. The spurious root may be easily known by its white or pale-gray colour, and its intense, disagreeable, persistent bitterness. Many roots from the genera *Ipomœa* and *Convolvulus*, which are more or less purgative, might be sub-

stituted for true jalap; but as they are not actually used for the purpose in Europe, it is not necessary to notice them here. Jalap resin has been adulterated with guaiacum resin and colophony. These may be detected by the solvent power of ether, which does not act on pure jalap resin (Gobley).

Actions and Uses.—Jalap is in its action an irritant, and on this account cathartic. A large dose produces violent hypercatharsis, which may prove fatal. Two drachms will kill a dog. It purges when applied to a wound. In medicinal doses it acts as an effectual, yet mild purgative, producing repeated liquid, feculent stools, without much griping. In some people it excites severe nausea; but this is not a common effect. It is therefore one of the most convenient of purgatives, and is deservedly much in use, particularly in febrile diseases. Its energy may be usefully increased by a few grains of calomel. It has been stated, but I do not know on what authority, that its watery extract is more diuretic than cathartic; and that, if the resin be first removed by alcohol, water then yields a simply diuretic extract (Duncan). Its best forms are the simple Powder, the Compound powder, or the Resin. These must be all very thoroughly triturated, otherwise they are more apt to occasion griping; and the resin should be triturated with sugar of milk, or made into an emulsion with sugar and almonds. The powders are most conveniently given with simple water, or covered up with a little fruit-jelly, or best of all with syrup of orange or marmalade. The tincture is seldom used alone, but may be advantageously added to purgative draughts. Jalap is contained in another purgative tincture, the *Tinctura sennæ composita*, for an account of which see the article Senna.

The doses of the preparations of jalap are, *Pulvis jalapæ*, gr. x. ad gr. xxx. *Pulvis jalapæ compositus*, dr. ss. ad dr. iss. *Extractum jalapæ*, L. D. gr. vi. ad gr. xvi. *Resina jalapæ*, E. gr. iv. ad gr. xii. *Tinctura jalapæ*, fl. dr. i. ad fl. dr. iv.

JUNIPERI CACUMINA, *E. L. D.* *Tops of Juniperus communis, L. W. Spr. Juniper-tops.*

JUNIPERI FRUCTUS, *E. L. D.* *Fruit of Juniperus communis, L. W. Spr. Juniper-berries.*

JUNIPERI OLEUM, *E. L. D.* *Volatile oil of the berries of Juniperus communis, L. W. Spr. Oil of Juniper.*

OLEUM JUNIPERI, E. L. D.

PROCESS, *Edin. Lond. Dub.* To be prepared from Juniper-berries according to the general directions for volatile oils. *See Introduction.*

SPIRITUS JUNIPERI COMPOSITUS, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of Juniper-berries, bruised, one pound (fifteen ounces, L.); Caraway, bruised, and Fennel, bruised, of each an ounce and a half (two ounces, L.);

Proof-spirit, 7 pints (1 gallon, L. D.);
Water, two pints (enough to prevent empyreuma, D.)
Macerate the fruits in the spirit for two days (one day, D.), add the water, and distil off seven pints (a gallon, D.)—Mix and distil off a gallon (*Lond.*)

For. Names.—*Fren.* Genièvre.—*Ital.* Ginepro.—*Span.* Enebro.—*Port.* Zimbro.—*Ger.* Wachholder.—*Dut.* Jenever —*Swed.* En.—*Dan.* Enebär ; Jenbärtrãe.—*Russ.* Mojjevelnik obiknovennoi ; Beresk.

Figures of Juniperus communis in Nees von. E. 86.—Engl. Bot. 1100.—Steph. and Ch. iv. 141.

The Juniper was the Αρκευθος of Dioscorides, by whom its fruit, called αρκευθις, was used as a tonic, expectorant and diuretic.

Natural History.—It is the *Juniperus communis* of modern botany, and belongs to the Linnæan class and order *Diœcia Polyandria*, and to the Natural family *Coniferæ* or *Pinaceæ*. It is a common indigenous shrub, growing on the slopes of dry hills and banks, and sometimes assuming a low spreading form, sometimes rising erect to the height of eight feet, or under cultivation to twice that altitude. It is an evergreen, easily known by its minute, crowded, spine-like leaves, and its peculiar odour when these are bruised. It flowers in spring, and the flowers are succeeded by small roundish berries, containing three seeds, and ripening not till the autumn of the subsequent year. Juniper berries are imported into this country from the Baltic and the Mediterranean. They are about the size of currants, purplish-black, of a peculiar, aromatic, terebinthinate odour, and of a corresponding taste, with some sweetness at first, but followed by bitterness.

Chemical History.—They contain, besides lignin and water, 34 per cent of grape-sugar associated with salts of lime, 10 of resin, 4 of wax, 1 of volatile oil, and 7 of gum. The oil, their chief active ingredient, is got from the berries by distillation with water, and a similar oil may be obtained from the leaves. It is very pale greenish, lighter than water, little soluble in alcohol, and possessed of the odour and taste of the plant. Like pure oil of turpentine, it consists of ten equivalents of carbon and eight of hydrogen (Blanchet).

Actions and Uses.—Juniper, its berries, and its oil are stimulant, carminative and diuretic; and large doses are said to irritate the urinary organs and cause strangury. They are now little in use; yet the oil is held by some to be an excellent diuretic, and to act also like copaiva in arresting mucous discharges, especially from the urethra. The oil is contained in the spirituous liquor called Hollands,—one of its best forms as a diuretic. I have sometimes found five minims of the oil with a fluidrachm of spirit of nitrous ether, given thrice a-day in any common vehicle, produce diuresis in dropsy where other means had failed.

The doses of the preparations of Juniper are, *Juniperi fructus*, dr. i. ad dr. ii. *Juniperi oleum*, min. iv. ad min. vi. *Spiritus juniperi compositus*, fl. dr. ii. ad fl. dr. iv.

JUNIPERUS SABINA, *D.* See *Sabina.*

KINO, *E. L. D.* *Concrete exudation of Pterocarpus erinaceus, Lamarck, Enc.—DC. and of other undetermined genera and species.* (*Edin*) *Extract of Pterocarpus erinaceus, DC.* (*Lond.*) *Source undetermined* (*Dub.*) *Kino.*

TINCTURA KINO, E. L. D.

PROCESS, *Edin. Lond.* Take of
Kino, in (moderately fine, E.) powder, three ounces and a-half;
Rectified spirit, two pints;
Digest for seven (fourteen, L.) days and filter. (This tincture cannot be conveniently prepared by percolation, E.)

PROCESS, *Dub.* Take of
Kino powder, three ounces;
Proof-spirit, three old wine pints.
Digest for seven days, and then filter.

PULVIS KINO COMPOSITUS, L. D.

PROCESS, *Lond. Dub.* Take of
Kino, fifteen drachms;
Cinnamon, half an ounce;
Hard opium, a drachm.
Reduce them separately to very fine powder, and mix them.

FOR. NAMES.—The term *Kino* is adopted in all European languages.—*Tam.* Toomble hoan.—*Beng.* Dhak ke gond; Kuni; Kumuikus.

FIGURES of Pterocarpus erinaceus in Guillemin, &c. Flora Senegamb. 54.—As Pt. senegalensis by Hooker in Gray's Africa, t. D.—Nees von E. 337.

KINO is a remedy of modern discovery. In Moor's African Travels mention is made of a vegetable production observed in 1733 near the settlements on the river Gambia in Western Africa,—which seems to have been this drug. It was probably imported into Britain not long afterwards. For in 1758 it was met with in the drug-trade by Fothergill as an article imported from the Guinea coast under the name of Dragon's blood; and he was the first to distinguish it as a new and peculiar astringent substance, likely to prove serviceable in chronic dysentery. The commercial name, Kino, was probably derived from the East-Indian name, Kuenee or Kini, applied to one variety of the drug (Royle).

Natural History.—The botanical source of Kino was long quite unknown. Much confusion has arisen on this point, in consequence of the name having been used, as a generic term, to comprise various astringent productions from different vegetables and different quarters of the globe. In the first edition of this work a sketch has been given of the successive botanical researches which seemed to refer the drug of commerce to the *Pterocarpus erinacea* of Poiret, a fine forest tree, inhabiting Senegambia on the African coast, and which has been proved to yield by spontaneous exudation, tears very like the present Kino of the shops. This sort however is not now commercial, and perhaps never was so. And it has been lately ascertained that the only Kino imported into Britain for many years is derived, not from Africa at all, but from the East Indies. In 1839 Dr Gibson of the Bombay Service stated that kino is produced by the *Pterocarpus Marsupium* of Roxburgh, and was at that time an article of export from the Malabar coast. The subsequent inquiries

of Professor Royle, Dr Pereira, and Dr Wight have confirmed the statement of Dr Gibson, and established the fact, that all the kino of British commerce is prepared at Anjarakandy near Tellicherry in Malabar from the *Pterocarpus Marsupium* by an enterprising merchant, Mr Brown. The tree, which is one of the most magnificent of the Indian forests, yields from longitudinal incisions a great quantity of red juice, which, on being simply dried in the sun, cracks into little irregular angular masses constituting the kino of the shops. The tree abounds not only near Anjarakandy, but also, as I am informed by Dr Cleghorn of the Madras Service, in the extensive ghauts between Mysore and the Malabar coast, where he lately saw it growing everywhere in the unfrequented jungles, and whence he has sent me several specimens quite identical with the present kino of commerce. All recent observations concur in showing that the drug is an inspissated juice; and not an extract, as stated in several successive editions of the London Pharmacopœia.

East Indian Kino,—the ordinary kino of the shops,—commonly occurs in small angular masses between a pin's-head and a pea in size. Entire tears are never seen, on account of its brittleness. The masses are black, glassy, and opaque; but thin layers held between the eye and the light show a deep-garnet-red translucency. It is without odour and of an intense pure astringent taste, with barely perceptible bitterness. When chewed it readily breaks down, adheres to the teeth, and tinges the saliva blood-red. It is very friable and easily reduced to a dull cherry-red powder, which becomes browner when kept some time.

Chemical History.—Heat makes it burn almost like charcoal, without fusion and with scarcely any frothing or flame; and a scanty gray ash is left. Cold water, acting on it in fragments, renders them grayish and dull on the surface, slowly forms a cherry-red solution, and leaves a crumbly, grayish substance. Boiling water immediately dissolves a much larger proportion, and forms an intense blood-red solution, which, in the proportion of one part of kino to twenty-five of water, continues permanent on cooling. This solution yields with sesquichloride of iron a dark-green coarsely flocculent precipitate, in such abundance as to make the whole liquid pulpy,—with acetate of lead a gray precipitate,—and slowly with tartar-emetic a lake-red muddy jelly. Rectified-spirit dissolves about two-thirds of it, and forms a deep-brownish-red tincture. Proof-spirit is a less complete solvent; and therefore rectified-spirit is preferred by the London and Edinburgh Colleges for making the officinal *Tinctura kino.* This tincture cannot be made by the process of percolation, because the first portions of spirit form a clammy pulp through which the remaining spirit cannot pass, and sometimes gelatinizes when long kept. Dr Duncan first ascertained, that kino consists essentially of tannin and a gummy principle; and soon afterwards Vauquelin arrived independently at the same

conclusion. There is no good recent analysis of it, showing the proportion of its astringent principle; but this is obviously great.

Observations on other Varieties of Kino.—The exudation of *Pterocarpus Marsupium* is not the only substance known in commerce and medicine as kino. The name has also been given to several other exudations, and even to some extracts, which for fifty years past have occurred in European trade, and some of which, besides closely resembling the present kino in external characters, are probably not inferior to it as astringents. The most important of these are African kino, Dhak-tree kino, Botany-bay kino, East-Indian kino, Jamaica kino, and Columbia kino.

1. It is doubtful whether African kino ever formed any appreciable part of the kino of European commerce; and it is possible that the descriptions of it in works on pharmacy have been really taken from the kino of Malabar. The exudation of *Pterocarpus erinacea*, however, as described by the naturalists who have seen the tree in Senagambia, seems very similar. But their statements are not sufficiently minute to admit of a precise comparison of the two varieties.

2. Dhak-tree Kino (Dhak ke gond, *Beng.*) may be adopted as a distinguishing name for that which is obtained from a magnificent Leguminous tree, the *Butea frondosa*, DC.—Roxb.—Willd. (figured in Nees von E. Suppl. 79.—Hayne, x. 6.—Roxb. Cor. Pl. xxi.), the Maduga or Dhak-tree of the East-Indies. This variety was first mentioned by Sir Whitelaw Ainslie and by Roxburgh. I received specimens of it in 1834 from Professor Royle, and afterwards from Dr Jackson, lately Deputy-Apothecary-General at Calcutta. Although believed never to have been commercial in Europe, it is noticed as an officinal kino in the Dublin Pharmacopœia of 1807; and Dr Pereira has found it in an old pharmaceutic collection in London. It approaches nearer in its characters than any other kind to the kino of the shops, and indeed is with difficulty distinguished. It is a natural exudation, which flows from fissures in the branches of the tree in the form of a red juice, and concretes into tears which are at first red, but become black under exposure to the sun. In my specimens, four in number, it forms irregular, angular masses, seldom so large as a barley-corn, apparently black and opaque, but really of an intense garnet red-colour, and transparent in thin pieces. Many fragments present fibres of adhering bark on one of their faces. It has a strong pure astringent taste, breaks easily down when chewed, without adhering to the teeth, and tinges the saliva lake-red. It is very friable, and readily reducible to a cherry-red powder somewhat brighter in tint than that of ordinary kino. Heat makes it incandescent, without causing fusion, swelling up, or flame; and a pale, scanty ash is left after combustion. Cold water, acting on it in fragments, renders them slowly more transparent, forms a cherry-red solution, and leaves pale garnet-red gelatinous masses, like bassorin. Boiling

water immediately dissolves the greater part, and forms a deep blood-red solution, which, in the proportion of one part of kino to twenty-five of water, continues permanent for some hours when cold, but afterwards deposites a scanty pink sediment. This solution is acted on by reagents nearly as the solution of common kino. Sesquichloride of iron causes an abundant, dark-green, rather coarse flocculent precipitate, which converts the fluid into a pulp; acetate of lead throws down a grayish-pink precipitate; and tartar-emetic produces a lake-red, gelatinous muddiness. Alcohol forms a fine cherry-red solution with dhak-tree kino. It undoubtedly contains a large proportion of tannin; and experiments made in London represent it to yield so much as 90 per cent.

3. Botany-bay Kino, first described by White in 1790, is the produce of *Eucalyptus resinifera*, White,—Smith,—Willd.—DC. (figured in White's Voy. 25—Nees von E. Suppl. 92—Hayne, x. 5), the Brown-gum-tree of New-Holland, a fine tall tree belonging to the Natural family *Myrtaceæ*. It yields a red juice from incisions so profusely, that sixty gallons may be got from a single tree. The juice concretes upon the branches and trunk into a resinous-like substance, at first reddish and translucent, but afterwards chocolate-coloured and opaque. This substance was to be met with in English commerce as a kind of kino in 1802 (Duncan); but it seems to have been unknown for many years past in European trade. Its characters have been variously stated by White, Duncan, and Guibourt, from specimens apparently genuine. My own specimens, one of them from Dr Duncan's collection, the other obtained direct from Australia, differ in some measure from all of their descriptions. It is in irregular masses free of impurity, some of them as big as a walnut, generally covered with a reddish powder from attrition, compact, very brittle, of a chocolate-brown or deep brownish-black colour, resinous in lustre, and opaque even in thin fragments. It has a more bitter and less astringent taste than common kino, and when chewed it tinges the saliva dirty lake-red. It is easily reduced to an umber-coloured powder. Heat causes it to soften and swell up; and white smoke or dense flame is produced before the process of charring is completed. Small fragments placed in cold water do not undergo any change for an hour and more, but afterwards very slowly communicate a pale yellowish-brown tint to the water, with little alteration in their own appearance. Boiling water dissolves a considerable proportion of the powder, and forms a deep cherry-red solution; which, if made with one part of kino to twenty-five of water, parts with a copious brick-coloured deposit on cooling. The remaining solution, which is yellowish-brown, produces with sesquichloride of iron a deep-green coloured fluid, or else a finely-pulverulent deep-green muddiness, easily soluble in an excess of the reagent,—and with acetate of lead a grayish-yellow precipitate. Rectified-spirit dissolves a considerable proportion of it, and forms a

deep yellowish-brown tincture.—Duncan says Botany-bay kino presents in splinters a ruby-red transparency, and that it is astringent and sweetish, without bitterness. White says water dissolves only a sixth of it, but rectified-spirit five-sixths. Guibourt's specimen was porous, very impure, dark reddish-brown or black, and glassy in small fragments; and it dissolved entirely in boiling water with the exception of impurities, forming a blood-red solution, from which sulphate of iron threw down a blackish, and acetate of lead a reddish precipitate. I cannot account for these discrepancies.

The remaining articles known in trade as varieties of kino are all extracts, not natural exudations. 4. The first of these, which was once imported by the East-India Company under the name of East-Indian or Amboyna Kino, has been supposed the produce of *Nauclea Gambir*, Hunter,—the same plant which is well known to yield the varieties of catechu called Gambeer in trade. This kind is described by Dr A. T. Thomson and by Guibourt as occurring in small fragments, apparently portions of a broken-down dry extract, of a deep brown or black colour, shining, opaque in mass, translucent and ruby-red in splinters, without odour, and in taste very astringent, at first bitter, but afterwards sweetish. It tinges the saliva red. It easily forms a pale brown powder. Water dissolves two-thirds of it, and forms a deep reddish-brown solution, in which sulphate of iron causes a deep green, tartar-emetic a reddish, and acetate of lead a grayish-brown precipitate. Alcohol dissolves the greater part of it. The history of this substance is incomplete. It can scarcely be the produce of *Nauclea gambir*, as is generally alleged. The treatise of Hunter, the authority commonly quoted, does not contain any statement whence it can be inferred, that a substance is made from the Nauclea with characters such as those just laid down; and the three varieties of Gambeer made from this plant are clearly varieties of Catechu, with characters totally different (see Catechu).——5. Jamaica or West-Indian Kino, a variety not now met with in English commerce, is an extract obtained from the *Coccoloba uvifera*, Linn. (figured in Nees von E. Suppl. 32—Hayne, x. 4), or Sea-side Grape of the West-Indies, a tree belonging to the Natural family *Polygonaceæ*. As described by Duncan, and also by Guibourt, it occurs in fragments of various sizes, slightly vesicular, dark brownish-black, shining and opaque in mass, translucent and ruby-red in splinters, chocolate-coloured in powder, of a slightly acid, bitterish, astringent taste, infusible, friable, soluble almost entirely in boiling water, and to the amount of three-fourths in boiling rectified-spirit. Its watery solution is reddish-brown, gives a grayish-green or black (Bostock) precipitate with sulphate of iron, and a yellowish or grayish one with acetate of lead, but merely becomes somewhat turbid with tartar-emetic. It contains 41 per cent of tannin (Bostock).——6. Columbia Kino is a variety which was lately first mentioned by M. Guibourt; to whom I am indebted for specimens of it. It

is a late importation, and is said to have come into France from Columbia. Its botanical source is unknown. It forms masses towards three pounds in weight, which are covered with reddish-brown powder and resemble dragon's-blood. Its fragments, somewhat vesicular in structure, are dark brownish-black, shining, translucent, yellowish red in splinters, orange-red in powder, of a very astringent bitter taste, and in a great measure soluble in water as well as in rectified-spirit. Its watery solution, if made with boiling water, yields some deposit on cooling. The solution is wine-red, and gives with sulphate of iron a greenish-black, with tartar-emetic a reddish, and with acetate of lead a rose-coloured precipitate. It closely resembles the variety of catechu I have described as an article of English trade under the name of Colombo Catechu, and is not improbably the same substance differently made up.——It may be observed of all the extracts now described, that they partake fully as much of the nature of the Brown Catechus, as of Kino. If they are correctly considered varieties of kino, their number might be greatly increased; for many astringent vegetables yield an extract of similar external characters and chemical properties.

Adulterations.—After this description of the various substances which have at different times been known in commerce as kino, it will be obvious that a precise account of its adulterations is unattainable. The inferior sorts may be mixed with the finer qualities, or even substituted for them entirely. But it depends altogether on the acceptation in which the term kino is used, whether or not such specimens are to be held as adulterated. On the whole it seems most advisable to confine the term pharmaceutically to the natural exudations of *Pterocarpus Marsupium*, *Butea frondosa*, and probably *Pterocarpus erinacea*,—since their properties are all but identical. In that case the characters of true officinal kino will be,—that it is dark brownish-black, shining and opaque in mass, translucent and garnet-red in splinters, very friable, soluble almost entirely in 25 parts of boiling water, and forming a blood-red solution, which yields scarcely any deposit for an hour after it has cooled, and becomes a deep olive-green pulp with solution of sesquichloride of iron. By these characters East-Indian and dhak-tree kino may be satisfactorily distinguished from every other substance hitherto described under the same generic name, even from the natural exudation of the brown-gum-tree of New-Holland.

Actions and Uses.—Kino agrees closely with catechu in its action. Like that substance, it is a pure and energetic astringent; and all its subordinate physiological actions, as well as all its therapeutic applications, depend on that property. The reader is referred to the article Catechu for details as to its practical uses. The affections in which kino has been preferred to catechu are menorrhagia, in which it is used as an internal astringent, and fluor-albus, relaxed sore-throat, and aphthæ of the mouth or fauces, in which it is applied topically. It is thought not to be so efficacious

in chronic dysentery. Nevertheless it is undoubtedly serviceable in that disease, especially if given along with opium in the form of the London and Dublin *Pulvis kino compositus*, or in that of the *Electuarium catechu compositum* of the Edinburgh Colleges, in which the kino and opium are united with catechu and aromatics. The simple powder or tincture, given in mixture with water and syrup, is the usual form for other purposes. A little mucilage taken afterwards removes the disagreeable roughness it occasions in the tongue and throat.

The doses of its preparations are: *Pulvis kino*, E. L. D. gr. x. ad gr. xxx. *Tinctura kino*, E. L. D. min. xxx. ad fl. dr. ii. *Pulvis kino compositus*, L. E. gr. x. ad gr. xx.

KRAMERIA, *E. L. D.* *Root of Krameria triandra, Ruiz and Pavon in Flor. Peruv.—DC.—Spr.—Ratanhy-root.*

KRAMERIAE EXTRACTUM, *D.* *Extract of the root of Krameria triandra, Ruiz, &c.*

EXTRACTUM KRAMERIAE, E.

PROCESS, *Edin.* This extract is to be prepared in the same way as Extract of Liquorice root.

INFUSUM KRAMERIAE, L.

PROCESS, *Lond.* Take of
Krameria, one ounce:
Boiling distilled water, a pint.
Infuse for four hours in a covered vessel, and strain.

FOR. NAMES.—*Fren.* and *Ger.* Ratanhia.—*Ital. Span.* and *Russ.* Ratania.

FIGURES of Krameria triandra in Nees von E. 413.—Hayne, viii. 14.—Steph. and Ch. ii. 72.

THE RATANHY plant was discovered in 1779 by the botanical travellers Ruiz and Pavon; and about seventeen years afterwards Ruiz gave the first account of the medicinal virtues of its root. It was not however till 1816, when Hurtado published a paper on the subject, that ratanhy-root came into general use in Europe.

Natural History.—The plant inhabits sandy slopes in the mountainous parts of Peru, especially in the district of Huanuco and other localities where cinchona trees are met with. Its Peruvian name Ratanhia has supplied the trite officinal appellation of the root,—which the Colleges ought not to have abandoned in their pharmaceutic nomenclature. It is the *Krameria triandra* of Ruiz, and belongs to the Linnæan class and order *Tetrandria Monogynia*, and to the Natural family *Polygaleæ* of Decandolle, or *Krameriaceæ* of Lindley. It is a somewhat shrubby plant, with a perennial, woody, very branchy root. This is the only medicinal part. The root as imported consists of a short root-stock from half an inch to two inches in diameter,—and several roots proper, which are simple or branched, one or two feet long, and between the thickness of a goose-quill and that of a man's thumb. Branch roots of middle

sizes are the fittest for pharmaceutic use. Its bark, which constitutes nearly two-thirds of its weight, is dark brownish-red, wrinkled and warty on the root-stock, smoother on the branches, brittle, without odour, and of a strongly astringent, bitterish taste. The woody interior is yellowish-red, dense, tough, and of the same taste, but much weaker.

Chemical History.—Both the wood and the bark are rendered black by tincture of iodine. Cold water, cold rectified spirit, and proof-spirit, readily extract the active parts of the root. The cold watery solution of the root-bark is deep yellowish-red, and gives with sesquichloride of iron a deep grayish-brown, with corrosive sublimate a flesh-coloured, and with acetate of lead a grayish-yellow, precipitate. The infusion of the wood is similarly but much more feebly acted on by the same reagents.—The London College has adopted an *Infusum Krameriæ*, made with boiling water; but in this way a solution is obtained which becomes very turbid on cooling, because the extractive matter taken up by the boiling water is deposited as the infusion cools. The infusion made with cold water by percolation, as directed by the Edinburgh Pharmacopœia, produces the best *Extractum Krameriæ*. The bark thus yields about a third of its weight of such extract (Geiger), and the whole root about a ninth (Boullay). Cold water is to be used because it takes up chiefly coloured tannin, which is the active part; but boiling water dissolves also a little starch and some coloured extractive or apotheme, which is inert and is insoluble in cold, and sparingly soluble in boiling, water. As the tannin passes by oxygenation into the condition of apotheme when the infusion is long exposed to the air, even while cold, but still more if heated, the evaporation should be conducted quickly, or in a vacuum. The officinal extract when well prepared has a brick-red colour and some translucency, is somewhat deliquescent, and dissolves entirely in cold water. A commercial extract from South America, which is recognized by the Dublin College, considerably resembles kino, and is sometimes substituted for that drug in continental trade. It is dark-brown, shining and glassy on a fresh surface, brownish-red and transparent in splinters, considerably astringent to the taste, and soluble almost entirely in proof-spirit or boiling water, but only partially in cold water. It is readily distinguished from the best varieties of kino, the Indian and Dhak-tree kinos, by heat causing it to swell up, and by its solution giving with acetate of lead a grayish-yellow instead of a grayish-red precipitate. Some add, that lime-water, which causes a gelatinous precipitate with infusion of kino, merely reddens that of ratanhy; but this is a mistake, for a copious curdy precipitate is occasioned.——The bark of ratanhy-root has been analyzed by Vogel, by Gmelin, and by Trommsdorff. According to the analysis of Trommsdorff, which is probably the most correct, it consists of 42.5 per cent of tannin, 17.5 of dark-brown gum, 15 lignin, and 25 of a bitter extractive matter (apotheme of Berzelius),

insoluble in cold water, sparingly soluble in boiling water, but freely soluble in solution of potash. The last principle is the cause of the inferiority of the extracts prepared from decoctions of the root. Vogel found in ratanhy-root a little starch. Peschier, who also analyzed it, found a peculiar crystalline acid, which he called Krameric acid, and which is peculiarly distinguished by its affinity for baryta exceeding that of sulphuric acid.

Adulterations.—Ratanhy root is not much subject to adulteration. The root of *Krameria ixina* (figured in Hayne, viii. 13), a native of South America and the West Indies, is said to be sometimes mixed with it, but is probably quite identical in properties. Geiger mentions a spurious ratanhy-root as occurring sometimes in continental trade, which is easily distinguished by its gray bark and pale yellow wood.

Actions and Uses.—The root of the Krameria is a powerful and pure astringent. It has been chiefly used as an internal astringent in hæmorrhagies, especially passive menorrhagia and hæmatemesis; and it has also appeared useful in some cases of chronic mucous discharges, colliquative sweating, and incontinence of urine. It is an energetic topical styptic for arresting hæmorrhage from the nostrils, the cavity of an extracted tooth, or the surface of a wound. The attention of Ruiz was first called to it, on observing it to be much in use among the ladies of Peru as a dentifrice; and it is held in European practice to possess peculiar virtues in reddening and consolidating the gums, as well as in whitening the teeth. As a topical styptic, it is used in the form of fine powder. Internally its best form is the infusion, or extract. The latter is commonly given in the form of pill; and both are easily taken in that of syrup. Acids should be avoided in using its preparations, as they tend to precipitate the tannin. It renders the tongue red, as in some fevers.

The doses of its preparations are: *Pulvis krameriæ*, scr. i. ad dr. ii.—*Extractum krameriæ*, E. gr. xx. ad gr. xl.—*Infusum krameriæ*. L. fl.unc. ii. ad fl.unc. iv.

LACMUS, *E. L.* LITMUS, *D.* *A peculiar colouring matter from Roccella tinctoria, Acharius, Lichenog. Univ.* (*Edin*).—*The prepared thallus of Roccella, &c.* (*Lond*).—*The plant of Roccella tinctoria, &c.* (*Dubl.*)

For. Names of Roccella tinctoria.—*Fren.* Orseille.—*Ital.* Oricello; Orcella.—*Span.* Orchilla.—*Port.* Orzella.—*Ger.* Lakmus flechte.—*Swed.* and *Dan.* Orseille.—*Dut.* Orcel.

Figure of Roccella tinctoria in Nees Von E. 9.

Litmus is admitted into the Pharmacopœias solely as a pharmaceutic reagent. It was at one time obtained, as the Colleges indicate, only from the *Roccella tinctoria.* But various other lichens yield a substance identical, or nearly so with litmus; and it is now

actually prepared in France from *Variolaria dealbata* and *V. orcina*, and in Holland from *Lecanora tartarea.*

Natural and Chemical History.—The *Roccella tinctoria* is a small, dry lichen, whose foliage or thallus resembles a diminutive leafless shrub, being forked and subdivided into numerous, branchy, roundish, gray, yellowish, or brownish threads. It abounds on rocks in hilly localities near the coasts of the Canaries and Cape de Verd islands, and it occurs also in the islands of the Grecian Archipelago, in other isles of the Mediterranean, and in Portland island and Guernsey. It was at one time an important article of commerce; for it was exported from the Cape de Verd islands alone to the annual average value of 50,000 dollars, and sometimes it brought six times that sum in a single year. But other lichens have now in a great measure supplanted it, especially *Roccella fuciformis* from Angola and Madagascar. It has been found by Nees von Esenbeck to contain a resinoid matter, a waxy principle, mucilaginous extractive, lichenin (see Cetraria), and various salts, among which oxalate of lime is the most remarkable. Heeren obtained from the plant a peculiar acid, the Roccellic acid, which is crystallizable, fusible about 250°, and of a fatty appearance,—and another principle, supposed by him to be neutral, but since proved by Schunk to be a crystalline acid, and which, though colourless, is the source of the colouring matter of litmus. The latter principle, called Erythric acid, is soluble in alkaline solutions, and converted by them into orcine and carbonic acid; and under exposure to air the solution acquires first a red and at length a fine violet tint. Its constitution is $C^{34}H^{11}O^{15}$.

The *Lecanora tartarea* (figured in Nees von E. 7) consists of small, dry, grayish-white, earthy-like, roundish, closely aggregated scales. It is a common plant on rocks in hilly parts of this country, but is particularly abundant in Sweden and Norway, whence it is largely imported for the use of British manufacturers. It has been found by Schunk to contain a principle Lecanorin, analogous to the erythric acid of the last species, but of the constitution $C^{18}H^{8}O^{8}$.

The *Variolaria dealbata* is a very white lichen in the form of irregular crusts about the size of a lentil, which adhere firmly to rocks. It abounds in Auvergne and on the Pyrenees, where it is collected in great quantity for French manufacturers. According to Coq, the *Variolaria orcina* is also largely collected in Auvergne, though Fée maintains the true species to be *Lecanora parella*, a species which Coq alleges to be incapable of yielding a violet colouring matter at all. Robiquet obtained from the *Variolaria dealbata* a substance intermediate between concrete oil and resin, and a peculiar principle, named Orcin, which appears to be a product of the decomposition of erythric acid and lecanorin. It is crystalline, colourless, sweetish, fusible, volatile, soluble in alcohol, and capable of producing a deep violet colouring matter (orceïn) under si-

multaneous exposure to the air and to fumes of ammonia. A solution of this colouring matter in water is decolorized by sulphuretted hydrogen and by a vacuum, but is restored to its violet tint by exposure to the air; so that oxygen plays an important part in the original development of the colour. Its constitution when anhydrous is regarded as $C^{18}H^{7}O^{3}$, and it is supposed to pass into orceïn $C^{18}H^{10}O^{8}N$ by absorbing five equivalents of oxygen and one of ammonia (Liebig).

The art of preparing a purple dye from one or more of the lichens seems to have been known to the ancient Greeks. It was subsequently lost till the beginning of the fourteenth century, when it was discovered by a native of Florence, who in consequence realized a large fortune, and founded the Florentine family of the Ruccellarii. The secret and the manufacture were afterwards transferred to Holland. Various dye-stuffs similar to one another in properties are now manufactured from various lichens in Italy, Holland, France, and Britain. Archil and Litmus are usually prepared from the *Roccella tinctoria* and *R. fuciformis*; the almost identical Orseille of France is made there from the *Variolaria dealbata* and *V. orcina*; and the *Lecanora tartarea* yields Cudbear in Scotland and litmus in Holland. It is probable however that other species of lichens are also employed for obtaining these substances.

Different accounts have been given of the mode of preparing these dyes; but all the processes consist essentially in exposing the lichen for a length of time to the simultaneous action of atmospheric air and ammonia, which is variously obtained from decaying urine, the distilled water of coal-gas works, &c. The plant gradually becomes purple and at length violet. Archil is the lichen, turned to violet, and uncompressed, so that it consists of a confused mass of violet-coloured threads. Litmus is the same substance beat to a pulp and dried in little cubes about the size of dice, which have an azure-blue colour, with white spots, an unpleasant odour, an earthy texture, much friability, and considerable solubility both in water and in alcohol. Its solutions have a splendid purple tint. The watery solution is not altered by alkalis, but is reddened by acids. It loses its purple hue if excluded from the air, and becomes brown; but recovers its original colour on exposure. A strong solution of litmus, fit for dyeing test-paper, is obtained by triturating one part with six parts of water gradually added, and then boiling the mixture for half an hour.

Adulterations.—Litmus is subject to be adulterated with chalk and with orris-root. The former may be discovered by effervescence being caused by muriatic acid, the latter by its peculiar odour of violets.

Uses.—It is used in pharmacy as a test of alkalinity and acidity, and is well suited for these purposes on account of its exceeding delicacy and the ease with which it may be both preserved and

applied. The ordinary way of using it is in the form of litmus-paper, stained as directed above, and kept both in the purple state and reddened by weak acetic acid. The stained paper must be preserved in well-closed vessels secluded from light. In testing for acidity, it is often useful to expose the purple-paper for a few seconds to the vapour of ammonia just before applying it, as the blue tint is rendered more pure and intense, and slight traces of acidity are thus more easily detected.

LACTUCA SATIVA, *D. The Herb.* L. VIROSA, *D. The leaves.*

LACTUCARIUM, *E. L. The inspissated juice of Lactuca sativa (Lond.)—of Lactuca sativa and Lactuca virosa, L. W. Spr. DC. (Edin.)—Lettuce-opium.*

EXTRACTUM LACTUCAE, L.

PROCESS, *Lond.* To be prepared from the expressed juice of the fresh leaves, like extract of Aconite.

TINCTURA LACTUCARII, E.

PROCESS, *Edin.* Take of
Lactucarium in fine powder, two ounces;
Proof-spirit, a pint.
This tincture is best made by percolation as directed for tincture of myrrh; but may also be prepared by digestion with coarse powder of lactucarium.

TROCHISCI LACTUCARII, E.

PROCESS, *Edin.* To be prepared with lactucarium in the same proportion, and in the same way as Opium lozenges.

FOR. NAMES of Lactuca. - *Fren.* Laitue.—*Ital.* Lattuga.—*Span.* Lechuge.—*Port.* Alface.—*Ger.* Lattich.—*Dut.* Salade.—*Swed.* and *Dan.* Laktuk.—*Russ.* Latik.

FIGURES of Lactuca sativa in Hayne, vii. 30,—of Lactuca virosa in Hayne, i. 47,—Nees von E. 250,—Engl. Bot. 1957.

THE ancients were acquainted with the calmative and soporific virtues of the lettuce, which seems to have been the Θϱιδαξ of the Greek physicians. But in modern times it had been almost lost sight of, till Dr Coxe of Philadelphia at the end of last century, and Dr Duncan Senior of Edinburgh not long afterwards, called the attention of practitioners to its properties.

Natural History.—Two species of lettuce are used in medicine now, as in ancient times,—the *Lactuca sativa* and *L. virosa.* They belong to the Linnæan class and order *Syngenesia Polygamia Æqualis*, and to the Natural family *Compositæ* in Decandolle's arrangement, or to the *Cichoraceæ* of Lindley. The *Lactuca sativa*, which was the species investigated by Coxe and by Duncan, is the Θϱιδαξ 'ημεϱος of Dioscorides, and our common garden-lettuce. The *L. virosa* is the Θϱιδαξ 'αγϱια of Dioscorides, and the wild or strong-scented lettuce of vernacular speech. The native country of the former is unknown; but it is cultivated in every part of Europe. The latter is an indigenous annual or biennial, which grows on stony and gravelly soil in waste places. It is easily distinguished

from the other by its rank smell, the blood-red spots on its stem, and the prickles on the keel of its leaves. Both species produce in spring a dense bunch of succulent leaves, from amidst which a flowering stem shoots up to the height of two or three feet in the garden-lettuce, and in the wild species to that of four, six, or even ten feet. Before the flowering stem begins to show itself, the garden-lettuce, as is well known, contains a pleasant, sweet, watery juice, and in this condition it is in universal use throughout Europe for salads. But in both species, no sooner does the flowering stem rise above the early leaves, than the juice grows milky, very bitter, and of a strong, peculiar rank odour, not unlike that of opium; and the milkiness and odour go on increasing till the flowers blow, which happens in the wild-lettuce during July or August, and in the garden-lettuce in August or September. So long as the juice remains clear, it contains chiefly sugar, mucilage, and albumen. But when it becomes milky, it also contains resin, a substance like caoutchouc, and a bitter crystalline active principle.

A considerable variety of preparations have at different times been obtained from the garden-lettuce; and as they are still to be met with in the shops, but differ much in nature, they must be carefully distinguished. The Colleges at one time recognised, under the name of *Extractum lactucæ*, a mere extract of the juice, obtained by beating lettuce leaves with a little water, and evaporating the expressed fluid. This is little better than an extract of the common sap, and contains only a small proportion of the proper juice. It has been retained in the last edition of the London Pharmacopœia, but apparently by mistake, as the College otherwise agrees with that of Edinburgh in expunging the plant from the Materia Medica and substituting the commercial lactucarium. Somewhat superior to this extract is the Thridace of the last Paris Codex, made from the same species by inspissating the expressed juice of the stems alone, collected while the plant is in full flower. ——These preparations are greatly inferior to the Lactucarium of Coxe and Duncan, as improved by the processes of Dr Young and Dr Probart. This is an inspissated exudation, obtained by cutting across the stem not long before the flowers begin to blow, scraping off the milky fluid that issues, cutting off a fresh slice as often as the surface ceases to yield juice, and allowing the collected produce to dry spontaneously.

The London College, however, and many cultivators, are wrong in restricting themselves to the garden-lettuce for the preparation of lactucarium. From information communicated to me fifteen years ago by Mr Duncan, Chemist and Druggist in this city, who has often made lactucarium on a large scale, it appears that the *Lactuca virosa* yields a much larger quantity, and that the produce is of superior quality. Nor is there any reason for dreading the narcotic properties of the wild-lettuce, the scientific name of which

has given rise to exaggerated notions of its activity. The results obtained by Mr Duncan have been since confirmed by those of Schutz in Germany; who found that a single plant of the garden-lettuce yields only 17 grains of lactucarium on an average, while a plant of wild-lettuce yields no less than 56 grains.——The *Lactuca Scariola*, another indigenous species which closely resembles *L. virosa*, and differs chiefly in having glaucous vertical leaves, instead of dark-green horizontal ones, is probably as fit for pharmaceutic use as the two other species; and more lately *L. altissima* which is often nine feet high and an inch and half thick, has been recommended as the best species of all (Aubergier).——An interesting observation has been made by Mr Duncan as to the time when the plant is most fit for yielding lactucarium. For he found that, although the milkiness of the juice increases till the very close of the time of flowering, namely in the wild-lettuce till the month of October in this climate, the value of the lactucarium is deteriorated after the middle of the period of inflorescence; for subsequently, although the juice becomes thicker, a material decrease takes place in the proportion of bitter extract contained in it.

Lactucarium, as prepared from the garden-lettuce, is commonly sold in roundish, compact. rather hard masses, weighing several ounces, of a wood-brown colour, of a strong peculiar odour approaching that of opium, and of a disagreeable bitter, somewhat acid taste. That of the wild-lettuce, as prepared on the large scale in this neighbourhood, is in pieces about the size of a field-bean or less, rough and irregular, wood-brown in colour, with an ash-gray efflorescence, so friable as to be easily crushed between the finger and thumb, reddish-brown in powder, of the same odour with the former, but more acid and bitter to the taste.

Chemical History.—The lactucarium from the garden-lettuce has been analysed successively by Klink, Schrader, Caventou, Dublanc, and myself, without an active principle having been satisfactorily discovered in it. More recently Pagenstecher got from it a bitter crystalline neutral matter, soluble in water and alcohol, and insoluble in ether; which however has not been shown to be the active principle. All agree in assigning to it a large quantity of a principle analogous to caoutchouc, some wax and resin, and about half its weight of bitter extract, in which its properties reside. —The lactucarium of the wild-lettuce has been of late more successfully examined by Walz. Heat softens it; partial fusion follows, with great increase of its peculiar odour; and at a higher heat it burns with a large white flame. Cold water takes up a sixth, boiling water a third of it; sulphuric ether, alcohol, and proof-spirit a larger proportion; and all these menstrua remove its bitterness. Proof-spirit is therefore correctly used by the Edinburgh College for preparing the *Tinctura lactucarii.* The action of water and of alcohol is strengthened by acidulation with acetic acid. In composition this substance is very complex; for it con-

tains a volatile oil, a yellowish-red tasteless resin, a greenish-yellow acrid resin, crystallizable and uncrystallizable sugar, gum, pectic acid, albumen, a brown basic substance, a principle like humus-extractive, a concrete oil or wax, one part of which is soluble in ether and fusible only at 212°, and the other insoluble in ether and fusible at 167°, numerous salts, among which oxalates are the most worthy of notice, and a peculiar neutral active principle, named Lactucin (Walz). The concrete oil or wax, insoluble in ether, was mistaken for caoutchouc by previous analysts, and the oxalic acid was mistaken by Klink and others for a peculiar one, which was called Lactucic acid.—Lactucin is obtained by exhausting finely powdered lactucarium with tepid rectified spirit acidulated with a fiftieth of acetic acid,—diluting the solution with its own volume of water, and precipitating the mixture with a slight excess of acetate of lead,—freeing the filtered solution from lead by sulphuretted-hydrogen gas, and evaporating it to dryness at a heat not exceeding 144°,—exhausting the extract with absolute alcohol, which is then distilled off,—and lastly, exhausting the residuum with sulphuric ether, and distilling off the ether till crystals form. The Lactucin is deposited in masses of obscure acicular crystals, which are colourless when pure, without odour, intensely bitter, easily fusible, soluble in 60 or 80 parts of cold water, more soluble in ether, still more so in alcohol, and also easily soluble in diluted acids, especially the acetic acid, but without neutralising them. The watery solution is very bitter, neutral, and not precipitable by any reagent. Eighteen per cent has been got from pure Lactucarium (Buchner).

Adulterations.—Lactucarium, by reason of its high price, may be expected to be liable to adulteration. In this country however it is at present usually to be had of genuine quality. The substitution of the expressed juice or extract for true lactucarium obtained by incision, is known by the former being almost entirely, whilst the latter is very slightly, soluble in the saliva when chewed.

Actions and Uses.—The investigations hitherto made on its action and uses are not precise or satisfactory. It appears however to be a narcotic poison to the lower animals in moderate doses; for ten or twenty grains are sufficient to cause sleep in dogs when swallowed, and the watery solution of twenty or thirty grains occasions sopor, coma and death if injected into a vein (Ganzel). The effects of medicinal doses on man have been variously reported. Coxe thought it a stimulant of the circulation. François on the contrary found it to retard and weaken the pulse, and to lessen the animal heat. Fisher maintains that it never excites the circulation, and is admissible even in acute inflammations. Caventou observed it to occasion placid sleep or calm rest, without influencing any other function but those of external relation, or causing any disagreeable subsequent effect. Ganzel witnessed the same results from doses varying between ten and sixty grains. It is therefore applicable in special diseases whenever a calmative, anodyne,

or hypnotic is desired; and its freedom from unpleasant after effects renders it in some cases preferable to opium. But the high price of the drug, together with the inertness of the old extracts once in general use, has prevented it from being thoroughly examined, or occupying the place to which it would seem entitled. ——Its best pharmaceutic preparation is the tincture. If it is to be given in the solid form it would probably be of advantage to concentrate its properties in a carefully prepared watery or acetous extract of the crude drug. François however maintains that its energy is greatly weakened by giving it in any other form than its original state.

The doses of its preparations are, *Lactucarium*, E. L. gr. x. ad scr. i.—*Tinctura lactucarii*, E. fl.dr. i. ad fl.dr. iii.—*Trochisci lactucarii*, E. xx. ad xl. daily.

LAURI BACCAE, *L. D.* *Berries of Laurus nobilis* (*Willd.—DC.*) *Laurel berries.*

LAURI FOLIA, *L. D. Leaves of Laurus nobilis* (*Willd.—DC.*) *Laurel leaves.*

For. Names.—*Fren.* Laurier.—*Ital.* Alloro.—*Span.* Laurel.—*Port.* Loiro.—*Ger.* Lorbeerbaum —*Dut.* Laurier-boom.—*Swed.* Lagerbärstræd.—*Dan.* Laurbær træe.—*Russ.* Lavrovoe derevo.

Figures of Laurus nobilis in Nees von E. 132.—Hayne, xii. 132.—Steph. and Ch. iii. 125.

The sweet-scented laurel is the Δαφνη of Dioscorides, and the oil obtained by decoction from its fruit is his Δαφνελαιον, both of which were much in use among the ancient physicians.

Natural History.—The plant is the *Laurus nobilis* of Linnæus and his successors, and is so called because it was the species of laurel used by the ancients for crowning their conquerors in battle or in the Olympic Games. Its vernacular names of Sweet-bay and Sweet-scented laurel have frequently led to its being confounded with the poisonous *Cerasus Laurocerasus*, the Common-bay or Cherrylaurel. It belongs to the Linnæan class and order *Enneandria Monogynia*, and to the *Laurineæ* or *Lauraceæ* in the Natural arrangement. It is a native of Asia Minor and the countries around the Mediterranean; but it thrives and even often ripens its fruit in gardens and shrubberies in this climate.

Its officinal parts are the leaves, the berries, and the oil obtained from the berries by expression. The leaves have an aromatic bitter taste, and an agreeable odour, and they contain a considerable quantity of volatile oil, which may be obtained colourless by distillation with water. The berries are about the size of hazel-nut kernels and deep-brownish-black when ripe. They yield by expression, with the aid of heat, a large proportion of an odoriferous concrete oil, of a verdigris green colour, and composed chiefly of

a crystalline fatty acid, laurostearic acid (Marsson), and volatile oil. The volatile oil seems to be almost identical with that of the leaves.

Uses.—Both the leaves, berries, and concrete oil are aromatic stimulants: but they are nearly abandoned in modern practice, and have indeed been expunged from the last edition of the Edinburgh Pharmacopœia. The berries constitute part of the *Confectio rutæ* of the London and Dublin Colleges.

LAUROCERASUS, *E.* PRUNI LAUROCERASI FOLIA, *D.* *Leaves of Prunus laurocerasus, L. W. Spr. DC.* *Cherry-laurel.*

AQUA LAUROCERASI, E. D.

PROCESS, *Edin. Dub.* Take of
Fresh cherry-laurel leaves, a pound;
Compound spirit of lavender, an ounce;
Water, two pints and a half (three old wine pints, D.);
Chop down the leaves, mix them with the water, distil off a pint, agitate the distilled liquid well, filter it if any milkiness remain after a few seconds of rest, and then add the lavender-spirit.
(Distil off a pint, and add the lavender-spirit, *D.*)

FOR. NAMES.—*Fren.* Laurier-cerise.—*Ital.* Lauro regio.—*Span.* Laurel real.—*Port.* Loirocerejo.—*Ger.* Kirsch-lorbeerbaum.—*Dut.* Laurierkers.—*Swed.* Lagerbär-körsbärsträd.—*Dan.* Lorber-kirsebærstræ.—*Russ.* Lavrovishnevoe derevzo.

FIGURES of Prunus Laurocerasus in Hayne, iv. 11.—Nees von E. 318.—Steph. and Ch. ii. 113.—Roque, 119.

THE CHERRY-LAUREL grows naturally in Asia Minor and Persia, especially around Trebizond; whence it was introduced into Europe by Clusius about the middle of the sixteenth century. It has since been extensively cultivated on the continent, and is now the most common of the ornamental evergreens of this country.

Natural History.—It is the *Prunus Laurocerasus* of Linnæus and most existing botanists, the *Padus Laurocerasus* of some, the *Cerasus Laurocerasus* of Lindley and others. It belongs to the Linnæan class and order *Icosandria Monogynia*, and to the Natural family *Rosaceæ* of Decandolle or *Amygdaleæ* of Lindley. Its vernacular names (Common-bay, Laurel, Cherry-laurel) have sometimes led to its being confounded with the *Laurus nobilis*, or Sweet-bay;—which may prove a serious mistake, as the former is an active poison, and the latter is not deleterious at all. It is a shrub or low tree, between fifteen and eighteen feet in height. It thrives excellently in this country, resisting in general the winter's cold, flowering in spring, and sometimes, even in Scotland, ripening its fruit in autumn. A cold of 14° F. may injure it (Mérat); and it was extensively destroyed throughout Britain in the severe winter of 1837-8. Its flowers are white and in a long cluster. Its berries are deep brownish-red or almost black, of the size and structure of the common cherry, and of a sweet mawkish taste. Its leaves, the only officinal part, are elliptic-oblong, from four to eight inches in length, sparsely serrated on the edge, stiff and leathery, bright green and shining, and provided with a gland on each side of the

midrib half an inch above the insertion of the leaf-stalk. The leaves of the *Prunus Lusitanica*, or Portugal laurel, another common evergreen, are sometimes mistaken for them, but are easily distinguished by their darker green tint, the want of a serrated edge, and the absence of glands. The leaves of the *Laurus nobilis*, or Sweet-bay, are not half the size of those of the cherry-laurel, and are easily known by their peculiar odour. Cherry-laurel leaves have not any fragrance unless they are bruised; but they then emit an agreeable ratafia odour, which is strongest in the young undeveveloped leaves during the month of May or June. They have a corresponding bitter, somewhat astringent, ratafia taste. When dried, their taste is bitter and astringent, without aroma, and they exhale no odour if bruised.

Chemical History.—Cherry-laurel leaves have not been carefully analysed. But they contain tannin, as their taste indicates; and they yield by distillation with water a hydrocyanated oil and distilled water, which are nearly identical with the essential oil and distilled water of bitter-almond. The oil does not exist in the leaves ready-formed, but seems to be produced by some mutual reaction of principles, brought in contact with one another when the cells of the plant are crushed and broken up. The quantity of oil they produce differs exceedingly in different circumstances;—a fact which, on account of the great energy of the oil as a poison, must be carefully attended to in using the leaves. Very mistaken notions prevail on this head. The common opinion is that full-grown leaves abound most in oil (Geiger,—Mérat). But this is at variance with what I ascertained in the course of some inquiries into the influence of season on the activity of plants. The leaves mostly remain on the bushes for eighteen months and upwards, and a few continue attached even during a third summer. The buds and unexpanded young leaves in May or June yield 6.33 grains of oil in one thousand. The proportion sinks to 3.1 grains when they have attained their full size in July, and goes on gradually diminishing to only 0.6 in the subsequent May, when they are twelve months old, and when the new unexpanded leaves of the same plant again give ten times as much. The proportion increases in some measure during the subsequent summer, but does not become in September so much as one-third of what is produced by the full-grown leaves of that year, which are an entire twelvemonth younger. Doubts have been thrown in Germany on these results; but on repeating them and testing the amount of hydrocyanic acid yielded by each, I find the quantity more than twice as great in developed young leaves as in old ones. Differences of soil and exposure also affect the proportion of oil, though in a less degree. It is easy to perceive the importance of these facts in relation to the dangerous practice of seasoning liqueurs and confections with the leaves of the cherry-laurel.

The distilled water of the leaves is the only officinal preparation of the plant. The instructions of the Dublin College for prepar-

ing it are imperfect. As the whole oil comes over with the first few ounces of water, and from its weight sinks at once to the bottom, brisk agitation is necessary to impregnate the whole water thoroughly and uniformly; and still farther to secure uniformity, filtration must often be practised, because from the great irregularity in the proportion of oil in the leaves, it will often pass over with the water in considerable excess, which must be removed. The properties of the oil and distilled water are the same with those detailed under the head of the bitter-almond (see *Amygdala*). The oil is said to contain sometimes only 2.75 per cent of hydrocyanic acid, sometimes so much as 7.66. Water dissolves it in the proportion of 3.25 grains to the fluidounce. A saturated watery solution should therefore hold only a very small proportion of hydrocyanic acid; yet it is said sometimes to contain a 400th of its weight (Schubarth). The proportion of acid in the distilled water diminishes with age; and at length, as I have had occasion to observe, it entirely disappears, although the ratafia odour may continue as strong as ever. The acid may be detected in the water by its ordinary tests (see *Hydrocyanic acid*), and more especially by adding first solution of potash, then a solution of the mixed sulphates of iron, and lastly a little sulphuric acid,—upon which a precipitate of prussian blue is formed.

Actions and Uses.—Cherry-laurel leaves and their distilled water are powerfully narcotic and in large doses poisonous by reason of the hydrocyanic acid which enters into their composition. The leaves have proved fatal to children from being too freely used for seasoning puddings and sweetmeats. The distilled water, the poisonous properties of which have been known only since 1737, has caused death in an adult in the dose of an ounce. This preparation was used as an anodyne and hypnotic long before the hydrocyanic acid, its active ingredient, was discovered; and of late it has come into use as a substitute for the medicinal hydrocyanic acid, because it is thought to be less apt to vary in strength. This however is a mistake, as is obvious from the variable proportion of oil in the leaves at different seasons, and in different leaves of one plant in the same season,—the varying proportion of hydrocyanic acid contained in different specimens of the oil,—and the gradual diminution of the acid in the water according to the length of time it has been kept. Still, if given with due caution in respect of its variable strength, cherry-laurel water is a convenient form for administering hydrocyanic acid. For an account of its therapeutic actions and special uses the article *Hydrocyanic acid* may be consulted.

The dose of *Aqua laurocerasi* is not well fixed, but is usually held to be from min. x. to min. xx. Much larger doses will often be required.

LAURUS CAMPHORA, *D.* See *Camphora.*

LAURUS CASSIA, *D.* See *Cassia.*

LAURUS CINNAMOMUM, *D.* See *Cinnamomum.*

LAURUS SASSAFRAS, *D.* See *Sassafras.*

LAVANDULA, *E. L. D.* *The flowers of Lavandula Spica (Lond.—Dubl.) The flowering heads of Lavandula vera, DC. Flore Française (Edin.) Lavender.*

LAVANDULAE OLEUM, *E.* *Volatile oil of the flowering heads of Lavandula vera, &c. Oil of lavender.*

LAVANDULAE OLEUM, E. L. D.

PROCESS. To be prepared from Lavender according to the general directions for distilling Volatile oils. See *Introduction.*

SPIRITUS LAVANDULAE, E. L. D.

PROCESS, *Edin. Lond.* Take of
Fresh lavender, two pounds and a half;
Rectified spirit, one gallon;
(Water, two pints, L.)
Mix them, and with a gentle heat (from a vapour-bath, E.) distil seven pints (a gallon, L.)

PROCESS, *Dub.* Take of
Fresh lavender, two pounds;
Proof-spirit, one gallon;
Water, enough to prevent empyreuma.
Macerate for twenty-four hours, and with a moderate heat distil two pounds by measure.

SPIRITUS LAVANDULAE COMP. E. D. TINCTURA LAVANDULAE COMP. L.

PROCESS, *Edin. Lond. Dub.* Take of
Spirit of Lavender, two pints (one pint and a half, L.—3 old-wine-pints, D.)
Spirit of Rosemary, twelve (ten, L.) fluidounces (one old-wine-pint, D.)
Nutmeg bruised, half an ounce (two drachms and a half, L.)
Cinnamon in coarse powder, an ounce (bruised two drachms and a half, L.—half an ounce, D.)
Cloves bruised, two drachms (none, L.)
Red Sandal-wood shavings, three (five, L.—eight, D.) drachms.
Let the whole macerate for seven (ten, D.—fourteen, L.) days, and then strain the liquor (through calico, E.)

FOR. NAMES.—*Fren.* Lavande.—*Ital.* Lavendola.—*Span.* Espliego.—*Port.* Alpacema.—*Ger. Dut. Swed.* and *Dan.* Lavendel.—*Russ.* Lavanda Kolosistaia.

FIGURES of Lavandula vera as L. angustifolia in Hayne, viii. 37.—As L. Spica in Nees von E. 178.—Lavandula latifolia figured in Hayne, viii. 38.—Nees von E. 179.

LAVENDER is supposed to be one of the oldest articles of the Materia Medica, being considered by Sprengel to have been the ἴφιον of Theophrastus.

Natural History.—The plant belongs to the Linnæan class and order *Didynamia Gymnospermia*, and to the Natural family *Labiatæ.* Under the name of *Lavandula Spica*, assigned to it by Linnæus, two similar but apparently distinct species are comprised, which were viewed by him as varieties merely. These are the *Lavandula vera* of Decandolle, Bentham and Lindley (*L. angustifolia*, Ehrhardt,—Mönch,—Hayne. *L. officinalis*, Villars. *L. Spica*, Nees von E.), and the *Lavandula latifolia* of Ehrhardt, Villars, Hayne, Nees von Esenbeck, and Willdenow (*L. Spica*, DC.—Bentham,—Lindley.) Both are inhabitants of dry hilly soils in the southern parts of Europe and the Mediterranean coast of

Africa, but thrive very well in this country. In a pharmaceutic point of view it is important to distinguish them. Both are perennial shrubs from two to four feet high, which produce spikes of fragrant lavender-blue flowers from July till September. The *Lavandula latifolia* is distinguished from the other most easily by its stature being less, its leaves considerably broader and somewhat spathulate, the flowering stem less clothed with leaves, the bracts larger and narrower, the corolla inferior in size and not so prominent, and the fragrance stronger but not so agreeable.

The flowers of both have a rich peculiar fragrance, and a strong bitter, aromatic, somewhat camphoraceous taste. They retain their odour for a long time when dried. Both species yield volatile oil by distillation with water. That from the broad-leaved species, called Spike-oil, is chiefly prepared in the south of France, and is much less esteemed than the oil of the true or narrow-leaved species, termed Oil of Lavender, which is prepared of very fine quality in England from plants grown for the purpose. The London College therefore is either altogether in error, or adheres too long to an obsolete nomenclature, in referring lavender and its oil to the *L. Spica* of Willdenow and Decandolle.

Chemical History.—The officinal preparations of lavender are its volatile oil and distilled spirit. The *Oleum lavandulæ* is obtained in the usual way in a proportion varying between two and five drachms from a pound of the flowers (Hagen). The *Spiritus lavandulæ* is variously prepared by distilling the flowers with proof spirit (Dub.) or rectified-spirit diluted with a little water to prevent empyreuma (Lond.) or rectified-spirit alone (Edin.). The last two methods are superior to the first; but in order to obtain a fine spirit with rectified-spirit alone, the regulated heat of the vapour-bath must be used. The spirit thus prepared, which contains only the oil of the plant in solution, is used for making another preparation extensively employed in practice, the *Spiritus* (or *Tinctura*, L.) *lavandulæ compositus;* which is a tincture of various aromatics.

Oil of lavender has a very pale yellow colour, a pure, grateful, lavender odour, and a bitter, aromatic, camphoraceous taste. Its density varies from 893 (Löwig) to 948 (Geiger). It is soluble in all proportions in rectified-spirit, in two parts of proof-spirit, and considerably in acetic acid. It absorbs oxygen when exposed to the atmosphere, and in four months and a half 120 times its volume of this gas will disappear (Saussure). It consists, like other oils from the same natural family, of a fluid oil or Elæoptin, and a solid crystalline substance or Stearoptin, the latter of which was considered by Proust to be almost identical with laurel-camphor, and has been found by Dumas to agree exactly with it in ultimate composition.

Adulterations.—Oil of lavender in this country is not subject to adulteration, and hence it has a high character on the continent, where the oil prepared in France and elsewhere is often mixed with

the cheaper spike-oil from *Lavandula latifolia.* This oil is stronger but not so agreeable in flavour as lavender oil, and besides is itself often adulterated with oil of turpentine. Its density is 877 (Löwig). Proust found that it contains a fourth of its weight of stearoptin; which indeed sometimes crystallizes in it spontaneously. Spike-oil is much used in France for making varnishes and in veterinary medicine.

Actions and Uses.—Lavender is in its action tonic, stimulant, and carminative. It is chiefly used as a perfume, or for aromatising extempore prescriptions; for which purpose the Spirit or Compound spirit is usually employed. The oil is a good carminative in flatulent colic, but inferior to the more pungent oil of peppermint. It has been thought useful by some in fluor albus and in gonorrhœa. The flowers form part of the *Pulvis asari compositus* of the Dublin Pharmacopœia, a sternutatory now scarcely in use.

The doses of the preparations of lavender are: *Spiritus lavandulæ,* min. xx. ad fl.dr. i., but chiefly for external use. *Spiritus* (*Tinctura,* L.) *lavandulæ compositus*, min. xxx. ad fl.dr. ii.—*Oleum lavandulæ*, min. v. ad m. x.

LEONTODON TARAXACUM, *D.* See *Taraxacum.*

LICHEN ISLANDICUS, *D.* See *Cetraria.*

LIMONES, *E. L.* *Fruit of Citrus Medica and Citrus Limonum, Risso, Ann. Mus.* xx.—*DC. Lemons and Limes* (*Edin.*)—*Fruit of Citrus Limonum, DC.* (*Lond.*)

LIMONUM CORTEX, *E. L.* CORTEX CITRI MEDICAE, *D.* *Outer rind of the fruit of Citrus Limonum, Risso, &c.* (*Edin.*) —*of Citrus Limonum, DC.* (*Lond.*)— *of Citrus Medica, Willd.* (*Dub.*)—*Lemon-peel.*

LIMONUM OLEUM, *E. L.* OLEUM VOLATILE CITRI MEDICAE, *D.* *Volatile* (*Distilled,* L.) *oil of the rind of the fruit of Citrus, &c.* (See last Article.) *Oil of Lemons.*

LIMONUM SUCCUS, *L.* SUCCUS CITRI MEDICAE, *D.* *Juice of the fruit of Citrus, &c.* (See last Article.) *Lemon-juice.*

SYRUPUS LIMONUM, E. L. D.

PROCESS, *Edin. Lond.* Take of
Lemon-juice strained (freed of impurities by subsidence and filtration, E.) a pint;
Sugar, two pounds and a half.
Dissolve the sugar in the lemon-juice with a gentle heat, and after twenty-four hours' rest remove the scum and pour the clear liquor from the dregs.

PROCESS, *Dub.* Take of fresh Lemon-juice, two pounds by measure. When the impurities have subsided, heat the juice in the vapour-bath for fifteen minutes. Pass it when cold through a sieve, and make it into a Syrup. See *Introduction.*

FOR. NAMES.—*Fren.* Limon.—*Ital.* Limone.—*Span.* Limon.—*Port.* Limao.—*Ger.* Limone.—*Dut.* Limoen.—*Swed. Dan.* and *Russ.* Limon.

FIGURES of Citrus Limonum, Risso, as Citrus Medica, Willd. in Nees von E. 424,—as Citrus Medica, var. limonum, by Hayne, xi. 27.

THE LEMON is sometimes onsidered to have been the Apple of Media of the ancients, the Μηδικον μηλον of Dioscorides, and the *Citreum* or *Malum Medicum* of the Latins. But others more correctly hold this to have been the citron, and believe the Lemon to have come originally from India and China.

Natural History.—The genus *Citrus*, in which the lemon-tree and several allied plants are included, belongs to the Linnæan class and order *Monadelphia Icosandria*, and to the Natural family *Aurantiaceæ*. The botanical subdivision of the genus has been rendered difficult by the varieties caused in the characters of the species by cultivation. Linnæus constituted, and Willdenow retained, the species *Citrus Medica*, as comprehending the plants which produce the lemon, citron, lime, and bergamot; and some botanists still hold all of them to be mere varieties of one common stock. The majority however believe, that at least several of these fruits are derived from distinct species, incapable of reproducing one another; and Risso, the best recent authority, establishes three species, *Citrus Limonum*, the lemon, *C. Medica*, the citron, and *C. Limetta*, comprising the lime and bergamot. The Edinburgh College has by mistake referred lemons and limes to Risso's *C. Medica* and *C. Limonum*, instead of to his *C. Limonum* and *C. Limetta*. The fruits of these plants are distinguished from the orange group of the same genus by a somewhat oblong form, a protuberance at the end opposite the foot-stalk, and a rind which adheres to the pulp. Compared with the lemon, as the most familiar among them,—the citron is larger, its rind tuberculated, more spongy and thicker, and its pulp less acid;—the bergamot is of less size, of a golden colour, in shape somewhat pyriform, and in taste bitterish and acidulous;—and the lime, which some consider a variety of the bergamot (Lindley), is scarcely half the size of the lemon, its rind greenish-yellow, dense and very thin, and its pulp bitterish and very acid. Farther, the rind of each has a peculiar characteristic fragrance. All of these fruits are properly speaking medicinal; but the most important, and in Europe the only one requiring particular mention, is the lemon.

The Lemon-tree is usually a shrub or low tree towards fifteen feet high; but some varieties attain four times that stature. Its original soil is unknown; for it has been long naturalized throughout the whole of the south of Europe, in northern Africa, the Levant, and very many of the more temperate countries of the Tropics. It is cultivated in great profusion in Spain, Portugal, Italy, Sicily, and the south of France. The fruit is botanically a berry, and is composed of a thin, yellow, odoriferous outer rind, a thick, white, scentless inner integument, and an acid yellowish pulp, in which

are imbedded several bitter mucilaginous seeds. Lemons take about ten months to ripen. They come to maturity in succession. A single tree has been known to produce 8000 lemons. The finest are those which are smoothest and thinnest in the skin. They may be preserved without trouble for a few months by pulling them before they are quite ripe, and wrapping each in paper; and they may be kept for a longer time in good condition, by packing them with newly-slaked lime in bottles or earthen-ware jars, the mouths of which are secured with corks and wax. They cannot be preserved in dry salt, or brine, or vinegar, as some authors and grocers recommend; for I find that in these circumstances the preserving fluid gradually takes the place of the juice. Even dry salt penetrates in the form of brine. The officinal parts of the lemon are the outer skin, and the juice of the pulp,—the *Cortex* and *Succus limonum.*

Chemical History.—LEMON-PEEL has a fragrant odour and a warm, bitter, aromatic taste. It becomes brown when dried, and loses in a great measure its warmth and its odour. The outer rind is studded with minute vesicles, which are filled with a volatile oil; and it also contains a bitter extractive matter. The oil commonly called OIL of LEMONS is obtained by distillation or expression. The finest is extracted in the latter mode by lightly grating the fresh fruit, subjecting the grated rind to pressure, and pouring the clear oil from the sediment which slowly settles. This oil is of a very pale yellow colour, and may be rendered colourless by distilling it. It has a rich lemon odour, and a hot, penetrating taste, agreeable when the oil is much diluted. Its density is 878 (Geiger). It deposits some crystals when cooled to 8° F. It absorbs oxygen when exposed to the atmosphere. It is soluble in all proportions in pure alcohol, but requires seven or eight parts of rectified-spirit for its solution. When quite pure it consists of 88.23 per cent of carbon and 11.77 of hydrogen, that is, 10 equivalents of the former and 8 of the latter ($C^{10}H^{8}$). It is thus isomeric with oil of turpentine, and like it absorbs muriatic acid gas, and forms an artificial camphor, consisting of one equivalent of oil and one of acid ($C^{10}H^{8}+HCl$).

LEMON-JUICE is obtained on the great scale by peeling the fruit, removing the seeds, mixing the pulp with finely-cut straw, squeezing the mass in canvas bags, and filtering it after the coarser impurities have subsided (Geiger). Various methods are resorted to for preserving it,—an object of great consequence both in respect to pharmacy, and still more to the victualling of ships on long voyages. Some are content with carefully corking the filtered juice in well-filled bottles; others subject it in the first instance for a few minutes to ebullition; others pour over it a thin layer of olive-oil. The British navy is supplied with it from Sicily preserved by the addition of a tenth of strong brandy; and druggists in this country, by adding about a tenth of spirit of wine and then filtering off the mucilage which separates, obtain a preparation which I have found to continue almost unchanged for several years in a

well-corked bottle. It becomes slightly bitterish after a time, but retains its strong acidity undiminished. Lemon-juice has an intense, grateful, acid taste, and a slight odour of the rind. It contains only 2.5 per cent of solid matter, of which 1.77 is citric acid, and the rest chiefly mucilage and malic acid (Proust). Citric acid is prepared from it by a process described under the head of that article.

Adulterations.—Oil of lemons is said by continental authors to be sometimes adulterated with fixed oil, and also with rectified spirit. The former impurity is detected by a stain being left on blotting paper from which a drop of it has been evaporated with a gentle heat,—the latter by a milky fluid being formed by agitation with water.

Actions and Uses.—Lemon-peel is much used in the arts of the cook and confectioner. It is employed in pharmacy as an ingredient of the *Infusum aurantii*, E. D. and of the *Infusum gentianæ compositum*, D. L. The oil is extensively used in perfumery, for seasoning numberless articles of confectionery, for aromatising extempore prescriptions, and as a substitute for fresh lemon-rind in preparing effervescing lemonade. It is considered a good anthelmintic in tape-worm.

Lemon-juice is in action tonic, refrigerant, and antiscorbutic. Its principal uses are for seasoning food, for making refrigerant drinks, effervescing draughts and laxative mixtures, and for the prevention and cure of scurvy. It is the most agreeable of all acids for seasoning food. Its use as a cooling drink in febrile diseases in the form of lemonade is familiar to all. An agreeable beverage, known as effervescing lemonade, is made with a composition of tartaric acid and oil of lemons instead of lemon-juice, strongly surcharged with carbonic acid. The proportions in which lemon-juice should be used for making effervescing draughts with the different alkaline carbonates and bicarbonates will be found under the head of carbonate of Soda. Two table-spoonfuls with one or two tea-spoonfuls of carbonate of magnesia make a gentle and agreeable effervescing laxative. Its most remarkable property is that of preventing and arresting scurvy,—a property in which it is equalled by no other remedy, except a liberal supply of fresh vegetables of the Cruciform family of plants. On long voyages an ounce, or an ounce and a half, of lemon-juice daily, is a preventive dose; and when the disease breaks out, four or six ounces a-day will arrest it. The prophylactic action of the remedy seems not to be exerted in all circumstances; but we are not accurately acquainted with the cause of its failure in some rare instances. The *Syrupus limonum* is of great service as a seasoning for the administration of other drugs in extempore prescriptions.

The doses of the preparations of the lemon are: *Oleum limonum*, min. x. as an aromatic; fl.dr. i. ad fl.dr. ii. as an anthelmintic.—*Syrupus limonum*, fl.dr. ii. ad fl.dr. iv. as a seasoning.

LINI SEMINA, *E. L. D.* *Seeds of Linum usitatissimum, L. W. DC. Spr.* *Linseed.*

LINI FARINA, *E. D.* *Meal of the seeds of Linum usitatissimum, L., &c., deprived of fixed oil by expression.* *Linseed-meal.*

LINI OLEUM, *E. L. D.* *Expressed oil of the seeds of Linum usitatissimum, &c.* *Linseed-oil.*

OLEUM LINI, D.

PROCESS, *Dub.* Triturate linseed in a mortar, and squeeze out the oil in a press without heat.

INFUSUM LINI, E. INFUSUM LINI COMPOSITUM, L. D.

PROCESS, *Edin. Lond. Dub.* Take of Linseed (bruised, L. D.), six drachms (an ounce, D.); Liquorice-root, bruised, two (four, D.) drachms; Boiling water, a pint (two pounds, D.) Digest near the fire for four hours in a covered vessel, and then strain (through linen or calico, E.)

PULVIS PRO CATAPLASMATE, D.

PROCESS, *Dub.* Take of Linseed, deprived of oil, one part; Oatmeal, two parts. Mix them.

CATAPLASMA SIMPLEX, D.

PROCESS, *Dub.* Take any convenient quantity of Cataplasm-powder; make a cataplasm with a sufficiency of water, and besmear the surface with olive oil.

FOR. NAMES.—*Fren.* Lin. *Ital* and *Span.* Lino.—*Port.* Linhaca—*Ger.* Flachs. —*Dut.* Vlas. *Swed.* Lin.—*Dan.* Hör.—*Russ.* Len.

FIGURES of Linum usitatissimum in Nees von E. 389.—Hayne viii. 17.—Steph. and Ch. i. 61.—Gr. and Morr. t. 11.

THE *Linum usitatissimum*, or flax-plant, was the Λινον of the Greeks and *Linum* of the Latins, to both of whom the demulcent properties of its seeds were well known.

Natural History.—Its native country is doubtful. General opinion has referred it to Egypt, on the ground that the Egyptian mummy-cloth was made of linen. The plant is now found wild in various parts of Germany, in southern Europe, and throughout Asia; and it grows freely in Britain. It is a herbaceous annual, belonging to the Linnæan class and order *Pentandria Pentagynia*, and to the Natural family *Lineæ* or *Linaceæ*. It produces in June and July beautiful azure-blue, glossy flowers; and in September it ripens its fruit, which is globular, and contains ten small, flat, ovate, pointed, smooth, slippery, shining seeds. The fibres of the stem yield flax or lint. The seed is the only officinal part.

Chemical History.—LINSEED consists of a mucilaginous tegument and oleaginous cotyledons. The entire seed yields about a sixth of dry mucilage and a fifth of oil (Hagen). It also contains wax, resin, tannin, starch, albumen, gluten, and several salts (Meyer). The mucilage of linseed, which is obtained by the action of boiling water on the entire seeds, possesses in a high degree the ropy viscidity which characterises that principle; and it is the chief source

of the demulcent properties of the officinal *Infusum lini.* The English and Irish Colleges, in their formulæ for this preparation, incorrectly order the seeds to be bruised; for in this way there is obtained a turbid mucilage, less agreeable to the taste. When the mucilage is dried it forms a brown gummy mass, which consists of 7.1·1 per cent of ashes, 10.3 of moisture, 52.7 of arabin or soluble gum, and 29.89 of an insoluble azotiferous gummy principle (Guerin-Varry), which Dr Thomson considers a compound of carbon, hydrogen and azote in the proportion of one equivalent of each. Mulder regards the pure mucilage as identical with pectin and pectic acid.

LINSEED-OIL is obtained from the seeds by expression without the aid of heat. When of good quality, its density varies from 927 to 934 (881, Gmelin, 950, Geiger). It is rather thick, of a pale amber colour inclining to green, and of a feeble peculiar odour. It resists a cold of 4° F. without concreting. When exposed freely to the air it becomes slowly thicker, and gradually hardens into a firm elastic varnish; which property is the basis of many important applications of this oil in the arts. The process of drying is accelerated if the oil be previously boiled, especially with a little litharge. It becomes easily rancid. It is soluble in forty parts of cold alcohol, in five of boiling alcohol, and in about one part and a half of ether. It is saponified by the alkalis. When agitated with limewater there is formed a white emulsion, consisting of an excess of oil holding a soap in suspension, which slowly subsides under repose. This emulsion is the officinal *Linimentum aquæ calcis*, or Carron-oil, once in universal use as a remedy for recent burns.

The cake which remains after expressing the oil, familiarly known by the name of Oil-cake, and when triturated, under that of Linseed-meal, is the officinal *Farina Lini.* This is one of the cheapest and best of all articles for making poultices. It is better in this state than the meal which contains the oil, because the latter when rancid is apt to irritate the skin. The Dublin College has thought this application of linseed so important as to have given a formula for a *Pulvis pro cataplasmate*, which contains it. A cheaper poultice consists of one part of linseed-meal and two of fine bran. The addition of two parts of mustard-flour makes a good sinapism.

Adulterations.—Linseed-oil is not particularly subject to adulteration. An inferior sort, obtained from the seeds by slightly roasting them before expressing the oil, or from the residue of cold drawn oil with the aid of heat and water together, is sometimes substituted for its better qualities. Rape-seed oil, which is used abroad for adulterating it, may be detected by the mixture not continuing fluid (Geiger) when treated with nitrate of mercury according the process for ascertaining the purity of olive oil (see *Oliva*).

Linseed is a powerful nutrient and demulcent. Oil-cake is well

known to fatten cattle quickly, but it renders their flesh coarse. The mucilage in the form of the *Infusum lini* is a cheap and effectual demulcent in urinary diseases, dysentery, and catarrh. The oil is used advantageously in the form of clyster for dysentery, hæmorrhoids and ascarides. Though nauseous, it was once given internally in dysentery, is often thus serviceable in colic, ileus, and lumbricus, and was thought by Baglivi a good remedy for pleurisy.

Externally it is chiefly employed in the form of *Linimentum aquæ calcis.* See *Calx.*

The doses of the preparations of linseed are *Infusum lini,* E. L. D. Oi. ad Oii. daily. *Oleum lini,* E. L. D. fl.dr. iv. ad fl.unc. iv. *Pulvis pro cataplasmate,* D. *Cataplasma simplex,* D. and *Linimentum aquæ calcis,* E. L. D. externally.

LINUM CATHARTICUM, *E. Herb of Linum catharticum, L. W. DC. Spr. Purging-flax.*

Linum catharticum figured in Hayne, viii. 18.—Eng. Bot. 382.—Gr. and Morr. t. 11.

PURGING-FLAX, though long known as a domestic medicine, has never come much into use in regular practice; yet all who have tried it speak of it as an excellent cathartic. It belongs to the Linnæan class and order *Pentandria Pentagynia,* and to the Natural family *Lineæ* or *Linaceæ.* It is a small indigenous plant, about six or eight inches in height, inhabiting dry pastures. It has a slender linear stem and branches, with small narrow smooth leaves. In June, July and August it produces elegant, little, white flowers which are pendulous before they expand themselves. The whole plant has an intensely bitter taste, and is without odour. It contains a white pulverulent acrid bitter matter, termed Linin, which is powerfully purgative, and is probably its active principle. It is insoluble in cold water, sparingly soluble in hot water and in ether, readily in alcohol and strong acetic acid (Pagenstecher).

Actions.—A drachm of the powder, or an infusion of two or three drachms of the herb, occasions brisk purging, generally without sickness or tormina. Linnæus, Withering, Geiger, and others have commended it as a purgative; and a friend assures me he has taken it, and found it not less effectual than convenient in its action. It seems therefore, although scarcely used in regular practice, to deserve being retained in the Pharmacopœias as a useful indigenous cathartic.

LIQUOR AETHEREUS SULPHURICUS, *D.* See *Aether Sulphuricus.*

LIXIVUS CINIS, *D.* See *Potassae Carbonas.*

LOBELIA, *E. L. Herb of Lobelia inflata, L. W. Spr. Lobelia.*

TINCTURA LOBELIAE, E.

PROCESS, *Edin.* Take of
Dried Lobelia in moderately fine powder, five ounces;
Proof-spirit, two pints.

This tincture is best prepared by the process of percolation as directed for tincture of capsicum; but it may be also made in the usual way by digestion.

TINCTURA LOBELIAE AETHEREA, E.

PROCESS, *Edin.* Take of
Dried lobelia, in moderately fine powder, five ounces;
Spirit of sulphuric ether, two pints;

This tincture is best prepared by percolation, as directed for tincture of capsicum; but it may be also obtained by digestion in a well-closed vessel for seven days.

FIGURE of Lobelia inflata in Bigelow's Med. Bot. i. 19.

THE *Lobelia inflata*, or Indian tobacco, was introduced into medical practice in the civilized world after the beginning of the present century, in consequence of the representations of Dr Cutler, a clergyman of Massachussets in the United States; but it had been long used previously by the savages and empirics of North America.

Natural History.—It belongs to the Linnæan class and order *Pentandria Monogynia*, and to the Natural family *Lobeliaceæ*. It is a common weed on roadsides and neglected fields throughout the United States. It is a biennial plant, between six inches and two feet in height, bearing small bluish flowers and inflated capsules. A milky juice issues from it when it is wounded. The whole plant, including the root, is collected for medicinal use, and not till August and September, when the capsules are formed; for it appears that although every part is active, the root and capsules are most powerful (Eberle). It is commonly imported into this country compressed into small rectangular cakes, as prepared by the Shakers of New Lebanon in the State of New York.

Chemical History.—In this condition it has a faint peculiar odour and a strong acrid benumbing taste, somewhat like that of tobacco. Water, alcohol, and ether dissolve its active part. Hence proof-spirit and etherised alcohol constitute good solvents; and they are accordingly used for making the officinal preparations of the Edinburgh College, the *Tinctura lobeliae* and *Tinctura lobeliae aetherea.* These tinctures, as the College indicates, are most conveniently made by the process of percolation; for the success of which it is necessary, that the material be firmly packed in the percolator. Lobelia has not yet been successfully analysed. A volatile active principle, perhaps analogous to that of tobacco, has been indicated by Wood and Bache, Dr Pereira, and Dr Colhoun of the United States. But other experimentalists have failed in obtaining similar results, and more lately Reinsch has described as its active principle, under the name of Lobeleïn, a shining yellow hygroscopic substance, bitter, with a tobacco-like after taste, which he got by the successive action of alcohol, ether and water.

Actions and Uses.—Lobelia is in large doses a narcotico-acrid poison, and in medicinal doses an emetic, sedative, diaphoretic, expectorant, and antispasmodic. As a poison it occasions violent vo-

miting, a peculiar acrid sensation in the throat, and subsequently anxiety, prostration, stupor, and convulsions. It is said that a tea-spoonful of its powder may prove fatal in five hours, if not vomited (Coxe). When chewed incautiously, an insupportable sense of burning and distension extends down the gullet; nausea ensues; and vomiting is apt to follow, accompanied with oppressive prostration like that caused by tobacco, and also with languor of the pulse and sweating. Less doses excite diaphoresis, promote expectoration without provoking cough, and tend to allay spasmodic action.

It has been used in the United States as an emetic for general purposes, as a relaxant enema in strangulated hernia and other intestinal obstructions, and as an expectorant antispasmodic in hooping-cough, catarrh, and asthma. Its chief application however in America, and the only use made of it hitherto in Britain, is as an antispasmodic for arresting the paroxysm of asthma. I may add my testimony to that of others in favour of its efficacy, not merely in true spasmodic asthma, but likewise in the fits of dyspnœa resembling asthma, which attend emphysema of the lungs and organic diseases of the heart. The breathing is commonly relieved by it in the course of five or ten minutes, and free expectoration ensues. It has appeared to me to lose its effect by frequent repetition. Its best preparation for spasmodic dyspnœa is either of the Edinburgh tinctures. Some prefer the combination of it with ether in the form of the *Tinctura lobeliæ ætherea*; but the simple tincture is perhaps not less efficacious.

The doses of its officinal forms are, *Pulvis lobeliæ*, gr. xx. as an emetic. *Tinctura lobeliæ*, E. fl.dr. iv. as an emetic; fl.dr. i. ad fl.dr. ii. twice or thrice, as an antispasmodic. *Tinctura lobeliæ ætherea*, E. in the same doses.

LUPULUS, *E. L.* HUMULUS, *D.* *Catkins (dried cones,* L. D.) *of Humulus Lupulus, L. W. Spr.* *Hops.*

INFUSUM LUPULI, L.

PROCESS, *Lond.* Take of
Hops, six drachms;
Boiling distilled water, a pint.
Infuse for four hours in a lightly covered vessel, and strain.

EXTRACTUM LUPULI, E. L. EXTRACTUM HUMULI, D.

PROCESS, *Edin.* This extract is prepared from hops in the same way as the Extract of Logwood.
PROCESS, *Lond.* To be prepared like Extract of Gentian.
PROCESS, *Dub.* To be prepared according to the general directions for making extracts. See *Introduction.*

TINCTURA LUPULI, E. L. TINCTURA HUMULI, D.

PROCESS, *Edin.* Take any convenient quantity of hops recently dried; separate by friction and sifting the yellowish-brown powder attached to their scales. Then take of this powder an ounce, and of rectified spirit eight fluidounces, and prepare the tincture by percolation or digestion as directed for Tincture of Capsicum.
PROCESS, *Lond. Dub.* Take of
Hops, six (five D.) ounces;
Proof-spirit, two (old-wine, D.) pints.
Macerate fourteen (seven, D.) days, and strain.

FOR. NAMES.—*Fren.* Houblon.—*Ital.* Lupulo ; Luppolo.—*Span.* Hombrecillo ; Hoblon ; Lupulo.—*Port.* Hombrezilho ; Lupulo.—*Ger.* Hopfe.—*Dut.* Hoppe.—*Swed.* and *Dan.* Humble.—*Russ.* Chmel.

FIGURES of Humulus Lupulus in Nees von E. 101.— Hayne, viii. 36.—Steph. and Ch. i. 41.—Engl. Bot. 427.—Bigelow, iii. 164.

THE HOP-PLANT was probably known to the Romans, being supposed to have been the *Lupus salictarius* of Pliny; but the Greeks were not acquainted with it, at least as a medicinal agent.

Natural History.—It is a native of the European continent and also of North America. Some consider it to be indigenous in this island; but the more probable doctrine seems to be, that it was introduced into the south of England from Flanders in 1524. It belongs to the Linnæan class and order *Diœcia Pentandria*, and to the Natural family *Urticaceæ* of Decandolle and of Lindley. It has a perennial creeping root, which sends up annually several very long, branchy, twining, herbaceous stems. It flowers from June to August. The male and female flowers are produced on different plants; and in the latter the inflorescence is succeeded by an egg-shaped catkin, or cone of leafy imbricated scales, which is the fruit of the plant. Each scale contains near its base a black seed, or achenium, which is surrounded by many minute, roundish, yellow, cellular, aromatic glands. In hop-fields, the seed aborts, as the female plant alone is cultivated. The cones constitute the hops of commerce. In England they are collected in September, and are dried in kilns. They have a peculiar, not agreeable odour, and an aromatic, intensely bitter taste. Their aroma is lost in the course of time; but the bitterness remains long undiminished. Their bitter taste resides in a great measure, and their aroma entirely, as Sir James Smith first pointed out, in the glandular grains which surround the seeds; and Dr Ives of New York showed that to them also hops owe whatever medicinal virtues they possess. As these grains are easily detached by thrashing, rubbing, and sifting the dried catkins, they ought to be substituted for the hops themselves, as the best form for officinal purposes. In this state they constitute a coarse yellowish powder, to which the name of Lupulin has been applied,—though incorrectly, since it is by no means a pure principle. Lupulin constitutes nearly a sixth part of hops when they are gathered in the proper season, and not over ripe, twenty-one pounds having been obtained from 150 pounds of hops (Ives). It soon loses its taste and odour unless carefully dried; and in all circumstances the aroma is impaired by keeping, so that the powder becomes of inferior quality even in the course of twelve months (Planche).

Chemical History.—Both hops and lupulin yield their sensible, as well as active, properties to water, and still better to alcohol or proof-spirit. Boiling water is used for preparing from hops the officinal *Infusum lupuli* of the London College. This infusion, and also the decoction, are acidulous to litmus paper, acquire a

deep-green colour with the salts of iron, and become turbid with solution of isinglass. From the decoction an extract is obtained, the *Extractum lupuli*, or *E. humuli* of the three Pharmacopœias; which is intensely bitter, but entirely without the aroma of hops. Proof-spirit,—a better solvent both of hops and of lupulin than water,—is employed for making the pharmaceutic *Tinctura lupuli.* That of the London and Dublin Colleges, prepared from hops, is a feeble preparation, and also wasteful, inasmuch as a good deal of it is retained in the bulky residuum. The Edinburgh tincture, a much superior form, is prepared from the lupulin of Ives by the process of percolation. The composition of lupulin, and of the leafy scales to which it is attached, has been examined by Dr Ives, and by MM. Payen, Chevallier, and Pelletan. Ives found his lupulin to be composed of 4.2 per cent of tannin, 9.2 bitter extract, 8.33 extractive matter without bitterness, 10 wax, 30 resin, and 38.33 lignin; but he subsequently found also volatile oil. The analysis of the French chemists, probably more exact, represents it to contain 10 per cent of bitter extract, 55 resin, 32 lignin, and 2 volatile oil, together with traces of tannin, gum, stearin, and various salts. And they found in the scales tannin, gum, chlorophyll, and lignin, but only a trace of the oil, bitter extract, and resin proper to the glandular grains. It is probably to the oil and bitter extract that hops owe their action on the animal body. The volatile oil, obtained by distillation with water, is pale-yellow, 910 in density, very acrid, of an intense, penetrating odour like that of hops, and convertible into resin by keeping. The bitter extract, called Lupulite by the French experimentalists, is pale-yellow, intensely bitter, not crystallizable, moderately soluble in water, more so in alcohol, and less so in ether. It is got by obtaining an alcoholic extract from the aqueous extract of hops mixed with lime, then preparing an aqueous extract from the alcoholic one, and finally washing the product with ether.

Actions and Uses.—Some uncertainty exists as to the action of hops. They are commonly stated to be tonic, febrifuge, anthelmintic, antilithic, and hypnotic. Their tonic property, which probably depends on their bitterness, is scarcely such as to impart to them the power of arresting periodic febrile action, as some imagine. But it is in part the source of the stomachic virtues of beer and other malt liquors. In these liquors hops serve the additional purpose of making them keep much longer than they would do otherwise. Though stomachic in small quantity, large doses interfere with digestion (Ives). Their anthelmintic properties are obscure, except inasmuch as all intense bitters are in some measure anthelmintic. Their antilithic virtues too are doubtful. Nevertheless, in the form of well-hopped beer, they are commonly held to correct the lithic diathesis of those who eat animal food in excess. The most important of their strictly medicinal properties, but one called in question by many, is their hypnotic action. A pillow

stuffed with hops has long been a popular remedy for procuring sleep; and it has even been adopted in regular practice. More convenient preparations being subsequently sought for, the watery extract and the tincture came into use. Ives afterwards substituted lupulin and its tincture, for the preparations of the hop itself, as hypnotics for general use, but especially in delirium tremens, and watchfulness in connection with nervous irritation, anxiety, or exhaustion. They have the advantage over opium of not disordering the stomach or causing constipation. Magendie however alleges he never could observe any effect on animals even from the preparations of lupulin; and many medical practitioners have failed to observe any soporific power in the officinal preparations of hops. The extract is probably quite destitute of hypnotic action. The officinal tinctures of London and Dublin also, can possess very little activity; for if the dose of 40 to 80 drops, given by Ives of his tincture of lupulin, be correct, one can scarcely see what may be effected by the common dose of 30 to 60 minims of the tincture of the hop itself; since this preparation does not contain above a tenth part of the active ingredients in Ives' tincture. Various reasons favour the conjecture, that, whatever hypnotic virtue may be possessed by hops, it resides in the volatile oil. Should this prove true, it is easy to see, that the ordinary officinal preparations must be inert, and that the only good form is fresh lupulin, either in substance or in the form of the *Tinctura lupuli* of the Edinburgh College.

The doses of the preparations of hops are: *Extractum lupuli*, E. L. *Extractum humuli*, D. gr. v. ad gr. xx.—*Tinctura lupuli*, L. *Tinctura humuli*, D. min. xxx. ad fl.dr. i. *Tinctura lupuli*, E. fl.dr. i. ad fl.dr. ii.—*Infusum lupuli*, L. fl.unc. i. ad fl.unc. iv.

LYTHRUM SALICARIA, *D.* *Herb of Lythrum Salicaria, L. W. DC. Spr.* *Willow-strife.*

For. Names.—*Fren.* Salicaire.—*Ital. Span. Port.* Salicaria.—*Ger.* Weiderich. —*Dut.* Partyke.—*Swed.* and *Dan.* Salicär.

Lythrum Salicaria figured in Nees von E. 296.—Hayne, iii. 39.—St. and Ch. iii. 146.

Some think this plant was the Λυσιμαχιον of the ancient Greeks. It has been long a popular remedy for chronic dysentery in different parts of Europe, and among the rest in Ireland. But as it is neither more nor less than a gentle astringent, and there are many other remedies of the same denomination in the Pharmacopœias, it may be expunged without detriment.

The plant belongs to the Linnæan class and order *Dodecandria Monogynia*, and to the Natural family *Lythraceæ*. It is indigenous in Britain, and also inhabits various parts of the European continent, Asia, and North America, growing in marshy places, and bearing beautiful long spikes of purple flowers. The leaves have a mucilaginous astringent taste, and undoubtedly contain tannin.

It is given in the dose of one or two drachms several times a-day either in powder or in infusion.

MAGNESIA, *E. L.* MAGNESIA USTA, *D.* *Magnesia.*

TESTS, *Edin.* Fifty grains are entirely soluble without effervescence in a fluidounce of diluted muriatic acid: an excess of ammonia occasions in the solution only a scanty precipitate of alumina: the filtered fluid is not precipitated by solution of oxalate of ammonia.

TESTS, *Lond.* Hydrochloric acid dissolves it without effervescence, producing a solution, which gives no precipitate with bicarbonate of potash or chloride of barium. It renders turmeric slightly brown.

PROCESS, *Edin.* Expose any convenient quantity of carbonate of magnesia in a crucible to a full red heat for two hours, or till the powder, when suspended in water, presents no effervescence on the addition of muriatic acid. Preserve the product in well-closed bottles.

PROCESS, *Lond.* Take four ounces of Carbonate of magnesia. Burn it for two hours with a strong fire.

PROCESS, *Dub.* Take any quantity of Carbonate of magnesia. Heat it strongly in a crucible for two hours; and preserve the product in glass bottles.

FOR. NAMES.—*Fren.* Magnésie.—*Ital. Span.* and *Port.* Magnesia.—*Ger.* Magnesia; Talkerde; Bittererde.—*Russ.* Genaia magnezia.

MAGNESIA (Calcined magnesia; Talc-earth; Bitter-earth; Oxide of magnesium) was first distinguished from lime by Dr Black in 1755. It exists abundantly in nature, rarely as a pure hydrate, occasionally as a pure carbonate, and also to a considerable extent in certain limestones. It exists in the form of salt in many springs and in sea-water. It is present, though in small proportion, in the animal solids and fluids, especially the urine; and in the shape of simple phosphate, or more commonly of double phosphate with ammonia, it is the chief ingredient of certain urinary calculi.

Chemical History.—It is usually obtained by heating the carbonate of magnesia till the carbonic acid is expelled. But it may also be prepared from its soluble salts by decomposing them with the caustic alkalis. The process by heating the carbonate, or calcination, requires particular management according to the degree of condensation desired in the product. In Britain a dense, heavy magnesia is preferred; but in France a preference has been generally given to that which is light. A light magnesia is best obtained by keeping the heat low,—a dense one by elevating it considerably, and also, by first moistening the carbonate and squeezing it strongly in a cloth (Robiquet), or beating it firmly into the crucible before heating (Dalpiaz). Dr Duncan supposes that the very dense qualities of magnesia prepared at the manufactories of Henry and of Howard are got by precipitating the earth from one of its soluble salts by means of caustic potash.—Magnesia may be also prepared economically by boiling calcined magnesian lime-stone (dolomite) with the bittern or mother-water left in manufacturing sea-salt. The lime displaces the magnesia in the liquid, and pure magnesia is thus produced, partly from the bittern, partly from the calcined mineral.

Magnesia is a pure white powder, of various degrees of denseness, obscurely alkaline and earthy to the taste, and feebly alkaline in its action on vegetable colours when moistened. It attracts from 12 to 20 per cent of moisture from the air, passing from the caustic to the slaked condition, but it does not absorb carbonic acid in a corresponding degree (Mialhe). Water sprinkled on it is absorbed, but without heat being evolved. It crackles slightly when thrown into water. It is very sparingly soluble in water; and it is less soluble at 212° than at 60° (Fyfe). Acids unite with it, occasioning much heat, and forming salts, some of which are soluble, and others not so. Its soluble salts are all bitter. Caustic potash throws down from their solutions a gelatinous hydrate of magnesia, probably composed of an equivalent of each ingredient. Magnesia, dissolved in the form of a salt, is distinguished from lime by three characteristic tests. If the solution be moderately diluted, oxalate of ammonia precipitates lime readily, but not magnesia. Ammonia on the contrary throws down magnesia, but not lime. The sesquicarbonate of ammonia precipitates lime, but not magnesia; and this may be afterwards thrown down by phosphate of soda in the form of a triple compound, the phosphate of magnesia and ammonia.——Magnesia consists of one equivalent of magnesium and one of oxygen (MgO); and consequently of 12.7 parts of the former and 8 parts of the latter.

Adulterations.—It is much subject to be adulterated with lime, alumina, and silica. It is often mixed with carbonate of magnesia, from having been unskilfully calcined, or carelessly preserved. And it may also contain a little adhering carbonate of soda or sulphate of magnesia, owing to insufficient washing of the carbonate of magnesia from which it is prepared. The testing formulæ of the London and Edinburgh Colleges provide against all these impurities. 1. If carbonate of magnesia be present, diluted muriatic acid occasions effervescence. 2. Silica is left undissolved by that acid; which however must be allowed some time to act, because magnesia is dissolved slowly, and in particular if very dense. 3. Alumina is indicated in the muriatic solution on adding an excess of ammonia, provided the acid, as the Edinburgh College directs, be used in considerable excess to the magnesia. For in a solution containing muriate of ammonia magnesia is not thrown down by ammonia in excess, while alumina is readily precipitated. 4. Lime is indicated in the muriatic solution by oxalate of ammonia (Edin.) or bicarbonate of potash (Lond.); neither of which will precipitate a moderately diluted solution of a magnesian salt, while either throws down lime in the form of a white powder, the oxalate or carbonate of lime. *A very convenient test for lime is also trituration of the magnesia with solution of corrosive sublimate; which does not affect pure magnesia, but renders it yellowish if lime be present, owing to liberation of binoxide of mercury. 5. Adherent sulphate of magnesia is indicated in the muriatic solution of magnesia by

chloride of barium, as the London College points out; for a white sulphate of baryta is thrown down if that salt be present. The Edinburgh formula disregards this impurity, and the London formula the more important adulteration with alumina.

Actions and Uses.—Magnesia is an antacid, antilithic, and laxative.—It is in great request as an antacid in dyspepsia attended with acidity, for which it possesses some advantage over alkaline remedies in being gently laxative. No remedy is more effectual for preventing gastrodynia than magnesia given a few minutes before a meal, or as soon as symptoms of acidity appear after eating. It is equally serviceable in the cases of children as in adults; and for acidity in infantile complaints it is in universal use.—It is a good antilithic, first, as a corrective of acidity in the stomach, and secondly, because where lithate of ammonia or free lithic acid abounds, the more soluble lithate of magnesia is formed. Accordingly some prefer magnesia even to the alkaline bicarbonates,—in general however, without reason.—In consequence of its antacid and antilithic properties, it is often useful in gout. Even the paroxysm of regular gout may be relieved by it; and in the affection intermediate between that disease and rheumatism, commonly called rheumatic gout, it frequently gives material relief from pain, especially when the force of reaction and of local inflammation is somewhat spent, and the pain has become chiefly neuralgic.——As a laxative, magnesia is now in most extensive use, sometimes singly, but more generally combined with mild vegetable purgatives. It is thought peculiarly serviceable in the instance of children. It is often united with rhubarb or with jalap; and such mixtures constitute excellent purgatives for general use in infancy. One of the best of the kind is the Edinburgh *Pulvis Rhei compositus* (See *Rheum.*) In the form of light magnesia, or still better the gelatinous hydrate, separated from solution of sulphate of magnesia by caustic potash, and not dried, it has been recommended as an antidote to arsenic by M. Bussy; and my experiments, like his, show that arsenic is thus as thoroughly removed from a solution, as by hydrated sesquioxide of iron. For solidifying copaiba it answers best when perfectly anhydrous (Mialhe). Fluid mixtures containing the light anhydrous magnesia are apt to become solid after some days; but this does not occur with Henry's dense variety, or with that which has become slaked by exposure to the air (Mialhe).

The preparations and doses of magnesia are as follows: *Magnesia,* L. E. *Magnesia usta,* D. for adults gr. x. ad gr. xv. twice or thrice a-day as an antacid or an antilithic, and scr. i. ad dr. i. as a laxative; for children gr. iii. ad gr. xii. as a laxative. *Pulvis rhei compositus,* E. dr. i. ad dr. iss. as a cathartic.

MAGNESIA USTA, *D.* See *Magnesia.*

MAGNESIAE CARBONAS, *E. L. D.* *Carbonate of Magnesia. Subcarbonate of Magnesia.*

TESTS, *Edin.* When dissolved in an excess of muriatic acid, an excess of ammonia occasions only a scanty precipitate of alumina ; and the filtered fluid is not precipitated by oxalate of ammonia.

TESTS, *Lond.* Distilled water boiled upon it does not affect turmeric, and is not affected by chloride of barium or nitrate of silver. It is soluble in diluted sulphuric acid, 100 parts thereby losing 36.6 in weight ; and the solution after effervescence is over yields no precipitate with bicarbonate of potash.

PROCESS, *Edin. Lond. Dub.* Take of
Sulphate of magnesia, four pounds (24 parts, D.) ;
Carbonate of soda, four pounds and 8 ounces (carb. of potash, 14 parts, D.) ;
Distilled water, four gallons (boiling water, 400 parts, D.)

Dissolve the salts separately, each in half the water ; mix the solutions, boil the mixture and stir it briskly for fifteen or twenty minutes. Collect the precipitate (on a filter of linen or calico, E.) ; wash it thoroughly with boiling water and then dry it.

TROCHISCI MAGNESIAE, E.

PROCESS, *Edin.* Take of
Carbonate of magnesia, six ounces ;
Pure sugar, three ounces ;
Nutmeg, one scruple.

Beat them in powder, with tragacanth mucilage, to a mass for lozenges.

FOR. NAMES.—*Fren.* Carbonate de magnésie.—*Ital.* Carbonato di magnesia. —*Ger.* Kohlensaure magnesia ; Kohlensaure talkerde ; Weisses magnesia. —*Russ.* Uglekislaia magnesia ; Velaia magnesia.

CARBONATE OF MAGNESIA (Subcarbonate of magnesia, Magnesia alba) seems to have been discovered about the beginning of the last century, when it was for some time sold in Rome as a secret nostrum under the name of Count Palm's powder. Valentin was the first who showed how it might be prepared (Geiger).

Natural History.—Several compounds of magnesia and carbonic acid are known in chemistry. The ordinary carbonate of the shops, as will presently be mentioned, is a subsalt, containing three equivalents of acid to four of base. When this is suspended in water and carbonic acid is freely transmitted, it is dissolved and becomes bicarbonate of magnesia. And when the solution is spontaneously evaporated, an equivalent of carbonic acid flies off, and an insoluble neutral carbonate is deposited. This neutral carbonate exists abundantly in nature. In its pure state it constitutes the mineral Magnesite, which abounds in some parts of Hindostan, and is used at Madras and Calcutta instead of the artificial carbonate. In an impure state it forms a considerable proportion of all dolomitic limestones. The dissolved bicarbonate is a rather considerable ingredient of some calcareous mineral springs, such as Karlsbad and Teplitz in Bohemia, Bilin in Hungary, St Allyre in France, San Giuliano near Pisa, and Saratoga in the United States of America. The subsalt is all obtained by artificial processes.

Chemical History.—Officinal carbonate of magnesia is prepared by adding an alkaline carbonate either to bittern, the mother-water of sea-salt, or to a solution of sulphate of magnesia. Double decomposition ensues, and carbonate of magnesia is precipitated. The phenomena of decomposition and the conditions for success are somewhat peculiar. If the saline solutions be mixed cold, the whole magnesia is not thrown down in the form of carbonate, for, while the neutral carbonate is in the act of forming, it is resolved by the

action of the water into two salts. Supposing five equivalents of carbonate of magnesia present,—one of them, abstracting carbonic acid from a second, remains dissolved in the form of bicarbonate; and the three remaining equivalents of carbonic acid combine with the remaining four equivalents of base, together with as many equivalents of water as there are of magnesia, and thus is constituted the insoluble officinal sub-salt. But if the mixture be then boiled, some carbonic acid is given off by the dissolved bicarbonate, and its magnesia falls down in the same state as the precipitate occasioned in the cold. If the solutions of the magnesian and alkaline salts be mixed at the boiling temperature, of course more complete precipitation is accomplished at once, and effervescence takes place from the escape of carbonic acid; but still ebullition of the mixture for some minutes is required to complete the process.——Doubts have arisen which of the alkaline carbonates is most fit for precipitating the magnesia. Carbonate of potash, formerly preferred by all the British Colleges, and still retained by that of Dublin, is more expensive than carbonate of soda; and besides, as it almost always contains silica, it has the disadvantage of introducing that earth as an impurity into the product. The carbonate of soda again, although preferred by the English and Scotch Colleges, in their new editions, on account of its comparative cheapness and purity, is liable to the objection, that it is more apt to be thrown down in small quantity along with the carbonate of magnesia in the form of a double carbonate (Mosander). This inconvenience however is in a great measure prevented by mixing the saline solutions hot, and by subsequent boiling.——It is an important object to obtain the carbonate of magnesia in the state of an impalpable powder, without grittiness; and public predilection has also led manufacturers to aim at obtaining it as dense as possible. These two qualities are not easily united. According to Dr Pereira, the dense variety is made by adding a cold saturated solution of carbonate of soda to a boiling solution of sulphate of magnesia in about four times its weight of water, and then boiling till effervescence ceases; and the precipitate is rendered gritty by mixing both of the solutions at the boiling temperature, and as much concentrated as possible. But the light variety is made by using the solutions considerably diluted. Bucholz gives a different account of the respective manipulations. The dense carbonate, he says, may be prepared by mixing boiling solutions of four parts of sulphate of magnesia in twenty-four of water, and four parts and three quarters of carbonate of soda in fourteen of water, and afterwards boiling for some minutes (Duncan); while the light kind is made by mixing cold solutions of the same quantity of sulphate of magnesia similarly dissolved, and of six parts and three-quarters of carbonate of soda in fourteen parts of water. And he maintains that the two kinds differ from each other in composition.

Officinal carbonate of magnesia is a pure white powder,—loose

and granular if dense, but somewhat coherent, like starch, if light, —tasteless, permanent in the air, and feebly alkaline in its action on vegetable colours. Heat expels its carbonic acid, as explained under the head of Magnesia. Water dissolves it in very small quantity, and more freely in the cold than at the boiling temperature (Fyfe). It is much more soluble however if the water be charged with carbonic acid, forty-eight parts of water being then sufficient. A solution is prepared in London, which is said to contain even eighteen grains in every fluidounce, or about a 20th of its weight of carbonate of magnesia (Dinneford). It is easily soluble in diluted sulphuric, nitric, or muriatic acid; and effervescence takes place. The solutions present the same characters with the corresponding solutions of calcined magnesia. It is generally conceived to consist of four equivalents of base, three of acid and four of water ($4MgO+3CO^2+4Aq$); and consequently of 82.8 parts of magnesia, 66.36 parts of carbonic acid, and 36 parts of water; but a recent analysis by Mr Edmund Davy assigns to it six equivalents of water. A difference of opinion prevails as to the precise manner in which its constituents are united. Berzelius, whose doctrine is most current, supposes it to be a compound of three equivalents of the hydrated neutral carbonate with one equivalent of hydrated magnesia.

Adulterations.—Its adulterations are the same with those of magnesia, and may be detected nearly in the same way as mentioned under the head of that article. The formula of the Edinburgh College contemplates the presence of alumina and carbonate of lime as adulterations; but does not provide against other impurities. That of London disregards alumina, the most common of them all, but provides against carbonate of soda or sulphate of magnesia, which may be present from insufficient care in washing the precipitated carbonate of magnesia, and against carbonate of lime or chloride of sodium, which may be introduced accidentally, as well as intentionally. Alumina is separated from the muriatic-acid solution by an excess of ammonia. Magnesia remains if the acid used to dissolve it was in excess, because ammonia does not precipitate magnesia in a solution of muriate of ammonia. Lime is indicated by oxalate of ammonia in the solution, after alumina has been separated by ammonia. In the London formula lime is indicated by a precipitate being occasioned with bicarbonate of potash in the muriatic solution; for this reagent does not precipitate magnesia. Carbonate of soda is indicated by turmeric becoming brown in distilled water, with which the carbonate of magnesia has been boiled: sulphate of magnesia or carbonate of soda is shown by chloride of barium occasioning a white precipitate in the same fluid: and chloride of sodium is indicated by means of nitrate of silver. The loss of weight sustained by dissolving the carbonate in sulphuric acid is a troublesome and unnecessary test.

Carbonate of magnesia is sometimes used in medicine in other

states besides that already described; but none of them is yet officinal.—One of these is a useful form, commonly sold under the name of Aërated Magnesian Water, and analogous in nature and properties to soda-water and potash-water. It is prepared as described under the article *Sodæ aqua effervescens.* It is known from other aërated waters by depositing a considerable precipitate of carbonate of magnesia when boiled. A bottle which holds about eight fluidounces may contain about seventy-two grains of carbonate, and ought to hold at least a scruple in solution.—Another form which has lately attracted some attention is Dinneford's Solution of Magnesia, adverted to above. It is said to contain from seventeen to nineteen grains of carbonate of magnesia in every fluidounce. The proportion seems to me overstated; for a specimen I received from the maker contains only 4.68 grains of caustic magnesia in 500; which are equivalent to 8.96 of commercial carbonate in a fluidounce. This solution retains the salt tolerably well, if kept in well-corked bottles. According to Mr Edmund Davy, when the carbonic acid escapes spontaneously or under exposure to heat, prismatic crystals are deposited, which consist of 29.61 per cent of magnesia, 32.22 carbonic acid, 10.7 water expelled at 212°, and 27.9 water separated on raising the heat to redness,—results which indicate a compound of one equivalent each of base and acid, and three equivalents of water ($MgO+CO^2+3HO$).——A third form, sometimes sold under the name of Soluble Magnesia, is a double carbonate of magnesia and soda. Both bicarbonate of potash and bicarbonate of soda possess the property of uniting with carbonate of magnesia. Either compound may be made by mixing a solution of sulphate of magnesia with a concentrated solution of either alkaline bicarbonate, and leaving the mixture at rest for a few days. Regular crystals are slowly formed. The carbonate of magnesia and potash consists of 35.3 per cent of bicarbonate of potash, 33 per cent of carbonate of magnesia, and 31.6 water of crystallization (Berzelius). It is not entirely soluble, water resolving it into insoluble carbonate of magnesia, and a solution of bicarbonate of both bases. The carbonate of magnesia and soda has not yet been carefully examined; but it is not so easily decomposed by water as the former salt, and is therefore probably in general the soluble magnesia of the shops. Both give off carbonic acid at 212°, and the magnesian carbonate then becomes insoluble. An attempt was made, but unsuccessfully, to introduce the soda salt into medical practice a few years ago as an antacid laxative. It ought, however, to be a convenient preparation for uniting the properties of the alkaline and magnesian carbonates in dyspepsia, gravel and gout.

Actions and Uses.—Carbonate of magnesia, like magnesia itself, is antacid, antilithic, and laxative in action. It is less active, since rather more than one-half of it consists of carbonic acid and water. It may be used for all the special purposes to which magnesia is

applied. As a laxative it is sometimes given along with lemon-juice, so as to form at the same time an effervescing draught. A drachm of carbonate of magnesia, the juice of one lemon, and a wine glassful of water, constitute a common domestic prescription; but the activity of the mixture is not great. When triturated with mercury it forms the *Hydrargyrum cum magnesia* of the Dublin Pharmacopœia, a useful preparation as an antacid alterative in chronic diarrhœa and dyspepsia, especially for children.

The doses of carbonate of magnesia are *Magnesiæ carbonas*, E. L. D. gr. xv. ad scr. ss. antacid and antilithic; dr. i. ad dr. ii. cathartic. *Hydrargyrum cum magnesia*, gr. v. ad scr. i. *Trochisci magnesiæ*, E. *ad libitum*.

MAGNESIAE SULPHAS, *E. L. D.* *Sulphate of Magnesia.*

Tests, *Edin.* Ten grains dissolved in a fluidounce of water, and treated with solution of carbonate of ammonia, are not entirely precipitated by 280 minims of solution of phosphate of soda (See *Tests*. 1 salt, 20 water).

Tests, *Lond.* Crystalline: very easily soluble: the solution does not give off hydrochloric acid on the addition of sulphuric acid. One hundred grains dissolved and added to a boiling solution of carbonate of soda yield 34 grains of dried carbonate of magnesia.

Process, *Dub.* Take of
Commercial sulphuric acid, twenty-five parts;
Water, one hundred parts;
Carbonate of magnesia, twenty-four parts or a sufficiency.
Mix the acid and water, and gradually add the carbonate to saturation.
Evaporate the filtered liquor, so that it may crystallize on cooling.

Enema Catharticum, E. D.

Process, *Edin.* Take of
Olive oil, one ounce;
Sulphate of Magnesia, half an ounce;
Sugar, one ounce;
Senna, half an ounce;
Boiling water, sixteen fluidounces.
Infuse the senna for an hour in the water; then dissolve the salt and the sugar; add the oil, and mix them by agitation.

Process, *Dub.* Take one ounce of manna; dissolve in ten fluidounces of compound decoction of chamomile; and add an ounce of olive oil, and half an ounce of sulphate of Magnesia.

For. Names.—*Fren.* Sulphate de Magnésie; Sel d'Epsom.—*Ital.* Solfato di magnesia; Sale d'Inghilterra; Sale d'Epsom.—*Span.* Sal amarga; sal de la higuera.—*Port.* Sal catthartico amargo.—*Ger.* Schwefelsaures magnesia; Bittersalz; Ebsamer-salz; Seidlitzer-salz.—*Swed.* Bittersalt; Engelskt-salt.—*Dan.* Engelsk laxeersalt.—*Russ.* Sernokislaia magnesia.

Sulphate of Magnesia (Epsom salt, English salt, Bitter salt, Seidlitz salt) was discovered in 1694 by Grew (Geiger). It exists abundantly in some mineral springs, as in those of Seidlitz and Saidschütz in Bohemia, of which it constitutes about one per cent, and above one-half the total saline contents. In the water of Epsom, whence it has derived its familiar name, it amounts to about a four-hundredth of the water. It is also contained in considerable proportion in the bittern of sea-water, from which common salt has been prepared. It is farther found in some soils, and sometimes effloresces in capillary crystals.

Chemical History.—At one time when this salt was not so much in use as now, it was chiefly obtained from the waters of Epsom, Seidlitz, and Saidschütz; and some parts of the continent are still

supplied from these sources. But the large quantity of sulphate of magnesia now used in Britain is prepared by various processes either from the bittern of sea-water, or from the mineral Dolomite, or from both together. It is unnecessary to specify the several processes, which have been published, and are more or less practised by manufacturers. The most important of them are the following. From bittern alone it may be obtained by simple evaporation and crystallization; but it is also usual in the first place to add a little sulphuric acid to the liquid, so as to convert into sulphate the chloride of magnesium which forms part of the saline ingredients. From dolomite, or magnesian limestone,—a common mineral, composed of carbonate of lime and carbonate of magnesia,—it may be prepared by converting the carbonates into sulphates, and separating the sulphates by means of the inferior solubility of that formed with lime. Or the mineral is calcined, and muriatic acid is added in such quantity as to unite with the caustic lime only, and the chloride of calcium being removed by solution in water, the insoluble magnesia is afterwards converted into the sulphate by sulphuric acid. From bittern and dolomite together the salt is procured by boiling the former with the caustic earths obtained from the latter by calcination; upon which the lime separates the magnesia of the bittern and takes its place in the solution, so that the magnesia from both sources is separated tolerably pure, and fit for being converted into sulphate (Dr Henry of Manchester).

Sulphate of magnesia is usually met with in small acicular crystals, transparent and colourless, of a cooling, saline, bitter taste, and slightly efflorescent in dry air. When slowly crystallized, it forms large rhombic prisms, often truncated on the obtuse edges, and terminated by two or four converging planes. Sulphate of zinc and sulphate of soda have the same crystalline form. A moderate heat causes it to fuse in its water of crystallization; a higher temperature renders it anhydrous; and at a full red-heat the anhydrous salt melts. It dissolves in its own weight of water at 60°, and in considerably less at 212°. It is insoluble in alcohol. The watery solution is decomposed by the alkalis and by lime, magnesia being precipitated. The alkaline carbonates throw down carbonate of magnesia; but the fixed alkaline bicarbonates and sesquicarbonate of ammonia do not affect a diluted solution, because the bicarbonate of magnesia is soluble. The soluble salts of lime and baryta decompose it, and precipitate the sulphates of these bases. Oxalate of ammonia does not affect a solution moderately diluted. If sesquicarbonate of ammonia be added to it, and then phosphate of soda, a double phosphate of magnesia and ammonia falls down at once in the form of fine powder, or in a diluted solution separates slowly in the form of minute acicular crystals. It consists of an equivalent of base, an equivalent of acid, and seven equivalents of water ($MgO + SO^3 + 7Aq$); and therefore contains 20.7 parts of magnesia, 40.1 of sulphuric acid, and 63 of water.

Adulterations.—Sulphate of magnesia obtained from mineral

springs frequently presents a variety of adulterations. But the salt now used in Britain seldom contains any impurity. A few years ago an article was met with in the market, said to be of Irish manufacture, which contained sulphate of soda. The formula of tests given by the London College supposes the salt to be sometimes adulterated with muriates; which will be detected by sulphuric acid disengaging muriatic acid gas. The separation of the magnesia by carbonate of soda with the view of weighing the carbonate of magnesia is a satisfactory mode of proving that no other sulphate is mixed with it, but is much too tedious and refined for ordinary use. The only test in the Edinburgh formula is intended to show by an easier method, that the full proportion of magnesia is present. Sesquicarbonate of ammonia being first added to a solution of ten grains of the salt, phosphate of soda is then added in such quantity, as to leave a little magnesia in solution if the salt be pure. Hence, if the filtered liquor shows no more magnesia when phosphate of soda is again added to it, the salt must have contained something else than sulphate of magnesia. The quantity of phosphate of soda added in the first place, namely 280 minims of a solution of one part in twenty of water, is sufficient to throw down 97 per cent of the magnesia in a pure sulphate.

Actions and Uses.—Sulphate of magnesia is a refrigerant cathartic, like many other neutral salts, and also a diuretic. It is at present more used as a general purgative than any other saline cathartic. It acts effectually, yet mildly, producing free watery evacuations, without any material tormina, debility, or sickness. It is chiefly used in febrile affections; in which its refrigerant action also renders it an appropriate remedy. But it may be also employed with propriety in other cases where a mild but efficient laxative is required. It possesses the usual diuretic action of the saline cathartics, but is never used as a diuretic. It may be given simply dissolved in water, which ought to be used in the proportion of at least eight times the salt. Sulphuric acid is an important addition. When added in sufficient quantity it covers the bitter taste of the salt, makes it sit easier on the stomach, counteracts its refrigerant effect, does not at all impair its energy, removes altogether its tendency to gripe or irritate the rectum, and even prevents it from interfering with the appetite and digestion. In order to secure these advantages however,—which, though long more or less generally known, were first clearly stated by Dr Henry,—it is necessary to give the acid more freely than usual, namely in the proportion of nineteen drops of concentrated sulphuric acid for every ounce of the sulphate. Henry's prescription directs seven ounces of water to be saturated with sulphate of magnesia, and an ounce of diluted sulphuric acid to be added to the solution. The dose of this is half an ounce or a table-spoonful in a wineglassful of water every hour or half hour until it take effect. An excellent compound saline cathartic consists of equal parts of Epsom salt and the tartrate

of potash and soda. Two or three drachms of this mixture in six ounces of tepid water act in general mildly, effectually, and without any inconvenience to the patient. Sulphate of magnesia is often given along with infusion of senna. A compound mixture of this kind, which will be found described under the head of senna, is perhaps the best of all purgatives for general use in fever and inflammations, as being both very effectual, and little apt to disorder the stomach.

The doses of Sulphate of magnesia are dr. ii. ad unc. iss. and upwards.

MALVA, *E. L.* *Herb of Malva sylvestris, L. W. DC. Spr.* *Common Mallow.*

DECOCTUM MALVAE COMPOSITUM, L.

PROCESS, *Edin.* Take of
Dried mallow, an ounce;
Dried chamomile, half an ounce;
Water, a pint.
Boil for fifteen minutes, and strain.

FOR. NAMES.—*Fren.* Mauve sauvage.—*Ital.* Malvone.—*Span.* Malvas.—*Port.* Malva.—*Ger.* Waldmalve; Pappelkraut.—*Dut.* Maluwe; Kaasjeskruid.—*Swed.* Kattostgräs.—*Dan.* Katteost.—*Russ.* Prosvirki.

FIGURES OF Malva sylvestris in Hayne, ii. 28.—Nees von E. 415.—Eng. Bot. 671.

THE COMMON MALLOW is believed to have been the Μαλαχη of Dioscorides and Malva of the Romans.

Natural and Chemical History.—It belongs to the Linnæan class and order *Monadelphia Polyandria*, and gives its name to the Natural family *Malvaceæ*. It is a native of this country, as well as of the European continent; and it grows abundantly on roadsides, under hedges, and on rubbish. It is a herbaceous annual, with a thick, long, succulent root, and a hollow branchy stem towards two feet high, which bears numerous, five or six-lobed, slightly hairy leaves, and produces from June to September reddish or purple pentapetalous flowers. The officinal part is the whole herb. It ought to be gathered while in full flower. All parts of the plant, the root, stem, leaves, flowers, and seeds, abound in mucilage; which may be said to be the chemical character of the natural family to which it belongs. Its composition has not been farther examined. It yields its mucilage readily to water by decoction. In this way is obtained its only officinal preparation, the *Decoctum malvæ compositum* of the London College; a form however which owes its properties chiefly to the chamomile combined with the mallow.

Actions and Uses.—The action of mallow is demulcent and emollient. Though once in general use, it is now confined chiefly to domestic and irregular practice. There is no good reason for this; for it is nearly on a par as a mucilaginous demulcent with other remedies of similar action, such as althæa-root, linseed, gum-arabic, and the like. The decoction is used internally. The leaves, boiled and beaten to a pulp, make a good emollient poultice. An infusion of the flowers, as it is turned green by alkalis

and red by acids, is sometimes used as a chemical test in the laboratory.

The dose of its only officinal preparation, the *Decoctum malvæ compositum*, L. is unc. iv. repeatedly.

MANGANESII OXYDUM, *E. D.* MANGANESII BINOXYDUM, *L.* Native impure Peroxide of Manganese.

TESTS, *Edin.* Muriatic acid aided by heat dissolves it almost entirely, disengaging chlorine; heat disengages oxygen.

TESTS, *Lond.* It is soluble in hydrochloric acid, and parts with chlorine. The solution gives with potash a white precipitate, speedily becoming brown. Ferrocyanide of potassium very rarely fails to render it green. One hundred parts of well dried oxide lose twelve grains at a white heat.

FOR. NAMES.—*Fren.* Oxide de manganese.—*Ital.* Ossido di manganese.—*Span.* Manganesa gris.—*Ger.* Manganhyperoxyd; Braunstein.—*Dan.* Brunsteen.—*Russ.* Perekis margantsa.

OXIDE OF MANGANESE (Black oxide, Peroxide, Binoxide of Manganese; Manganese; Brownstone; Glassblower's Magnesia) is not put to any medicinal use, but is an indispensable article for making solutions of chlorine, as well as the chlorides of lime and of soda. It has been long known as a natural production, constituting the mineral named Pyrolusite; whence all the oxide of manganese used in the arts is obtained. This substance however is always more or less impure; and lime, alumina, baryta and oxide of iron occur in it,—the lime and baryta commonly in the form of sulphate or carbonate.

Chemical History.—The native oxide used in pharmacy is a dark brownish-black compact mass, of considerable weight, and commonly earthy, though sometimes metallic, in its appearance. It is also met with pulverulent, and sometimes crystallized in right rhombic prisms, but more frequently in accreted needles. Its density is 3.7. Its powder is dark-grayish black, tasteless, permanent in the air and insoluble. When heated to a full-red heat it parts with some of its oxygen; and at a white heat it parts with still more, and becomes protoxide of manganese. When heated with sulphuric acid it also parts with half its oxygen, and combines with the acid to form a soluble salt. When treated with muriatic acid, chlorine is disengaged; and the action is increased by a gentle heat. The chemical changes that ensue are peculiar. Two equivalents of hydrochloric acid are decomposed for each equivalent of binoxide of manganese; two equivalents of oxygen from the latter unite with two of hydrogen from the former, and produce water; one equivalent of chlorine unites with the single equivalent of manganese to form the soluble chloride of manganese which remains in the state of a dark yellow solution; and one equivalent of chlorine passes off. The same phenomena and results ensue if muriatic acid be presented to the oxide of manganese in the nascent state, by mixing together the oxide, chloride of sodium and sulphuric acid.—— It is composed of one equivalent of manganese, and two equiva-

lents of oxygen (MnO^2), and consequently of 27.7 parts of the former, and 16 of the latter.

Adulterations.—The oxide of manganese of the shops always contains more or less of the impurities mentioned above. The Pharmacopœias have supplied processes for determining its degree of purity. The London and Edinburgh Colleges indicate the evolution of oxygen by heat, and of chlorine by muriatic acid, as the best criterions for distinguishing it; and the London College specifies the loss at a white heat as a character of its purity. If ferrocyanide of potassium render the muriatic solution or chloride green there is iron present. This is better shown however by adding a slight excess of ammonia to the solution of the mixed chlorides; upon which oxide of iron alone separates.

Actions and Uses.—Oxide of manganese has not any distinct action on the body in single doses, owing to its great insolubility. But it has been observed at Glasgow to act as a cumulative poison after the manner of mercury, lead, and arsenic,—having apparently brought on paraplegia, without any precursory affection of the bowels, in workmen employed in grinding it (Dr Couper). Gmelin found the sulphate of the protoxide to possess in a singular degree the power of increasing the secretion of the bile, but to produce also in animals symptoms of gastro-intestinal inflammation and paralysis. On the contrary Dr Thomson of Glasgow observed it to produce merely the mild purgative effects of the sulphate of magnesia, and it has been used as a cathartic in doses of from one to ten drachms (Ure).

MANNA. *Sweet concrete exudation probably from several species of Fraxinus, L. W. Spr.—and Ornus, Persoon's Syn.* (*Edin.*) (*Concrete juice of Ornus Europæa* (*Lond.*)—*of Fraxinus Ornus Dublin*).—*Manna.*

For. Names.—*Fren.* Manne.—*In every other continental language*, Manna.—*Arab.* Terinjebin; Mun.—*Pers.* and *Hind.* Shirkisht.

Figures of Ornus Europæa in Hayne, xiii. 11.—Steph. and Ch. i. 53.—as Fraxinus Ornus in Nees von E. 371.—Of Ornus rotundifolia in Hayne, xiii. 12.

It is doubtful at what period physicians first became acquainted with this substance. Notwithstanding its name, it differs entirely from the food of the Israëlites in the desert as described in the Scriptures. It is supposed by some to have been the Ελαιομελι of Dioscorides, and to have been obtained from the Μελια of Homer, a species of ash. But the Ελαιομελι of the Greeks, which was produced "at Palmyra in Syria by the olive-tree" (Dios. A. λζ.), was more probably the saccharine exudation of a species of *Tamarix*, which grows on Mount Sinai, as well as throughout other parts of Syria and western Asia.

Natural History.—In modern times Manna was long thought to be generated in the atmosphere. But in 1543 Palea proved it to be an exudation from a tree. Doubts still prevail as to its precise botanical origin. Some maintain that it is exuded by several species of the genus *Fraxinus* as established by Linnæus, and more particularly by several species of *Ornus*, a new genus detached by Persoon from the former. And *Fraxinus excelsior*, *Ornus Europæa*, *O. rotundifolia*, *O. parvifolia*, *O. subrufescens*, and *O. lentiscifolia*, have been indicated by different authors as capable of yielding the various qualities of manna. According to Professor Gusson of Naples, the only species that yields the finer kind of manna is the *Ornus rotundifolia*; and other species, particularly *Ornus Europæa*, have been supposed to produce it merely because the true plant is often engrafted upon them (Mérat). Tenore again maintains that the true plant is not the species *O. rotundifolia*, but two varieties of *O. europæa*, namely *O. europæa rotundifolia*, and *garganica*, the former of which is most generally cultivated for the sake of its manna (Hayne).

The manna-ash is a native of most parts of southern Europe, but thrives especially in Sicily and the south of Italy, whence the manna of commerce is derived. It is a handsome tree, from twenty to thirty feet high, with foliage not unlike that of the common ash, but with clusters of white fragrant flowers, which appear in May and June. Manna issues from it in part spontaneously from fissures, partly from punctures produced by an insect, the *Tettigonia Orni*, but chiefly from incisions made expressly in the bark. The juice flows out nearly colourless and somewhat viscous; and it soon hardens in the sun into a whitish or yellowish opaque substance. Some of it is allowed to fall on the ground or upon leaves spread to receive it. Some of it trickles down the trunk and branches, without any precaution being taken to ensure its purity. But where it is collected with care, leaves are stuck into the bark below the incisions, and straws or twigs are inserted into them, so that the juice concretes in the form of ridges or stalactites, and is easily detached clean from the bark. The manna harvest commences in July and continues till October. The best kind is obtained in the height of the season during the month of August, and the inferior qualities are produced towards the close.

Manna is imported from various ports in Italy and Sicily, but principally from Messina and Palermo (Pereira). There are many varieties of it, which chiefly differ from one another in quality according to the season and mode of collection.—The only kind in much demand in this country is the finest sort, collected in the middle of the season upon straws or twigs, and called in trade Flake manna from its form. It is the Manna Gerace of the Sicilians, and the officinal *Manna canellata*. It is light, brittle, dry, white or pale yellowish-white, and formed of stalactitic masses, which are about six inches long, one inch broad, and hollowed slightly on the

side by which they adhere to the tree. It has a faint odour, and a rather pleasant, sweet, somewhat sharp, peculiar taste. When long kept, its white colour becomes tarnished, and gradually passes to yellowish-red or brown. It is evidently composed of several layers, and its fresh fracture presents traces of crystallization internally.—Another esteemed kind, but rare, and scarcely commercial, is in small white grains, formed by spontaneous exudation, and preserved clean by collecting them before they fall on the ground.—The inferior qualities, obtained towards the end of the season, and not carefully collected, are variously called Calabrian manna or Manna in grains, Sicilian manna, Manna in sorts, Tolfa manna, or Fat manna. These form roundish or irregular masses of various sizes, of a yellowish-red or yellowish-brown colour, of a strong, honey odour, and of a mawkish, sweet, unpleasant taste. They are adhesive, soft, not brittle, and generally mixed with fragments of bark, sand, and other mechanical impurities.

Chemical History.—Manna softens with the heat of the hand, and melts at a temperature somewhat higher. It is almost entirely soluble in three parts of temperate water, and in eight parts of temperate rectified spirit. It has been analyzed by Fourcroy and Vauquelin, by Bucholz, by Thenard, and by H. Rose. The result of these investigations is, that it consists of about 60 per cent of a peculiar sweet principle called Mannite, a little common sugar, partly crystalline and in part uncrystallizable, probably a little gum, a small quantity of a yellow, nauseous, uncrystallizable extractive substance, and about 32 per cent of moisture.—Mannite is obtained by allowing a boiling alcoholic solution of manna to cool; upon which it is deposited in colourless, acicular, four-sided prisms in radiated tufts. It is scentless, sweet, soluble in water, less so in alcohol, and not fermentable with yeast. Nitric acid converts it partly into oxalic, but partly also into mucic acid. According to the ultimate analysis of Liebig and Pelouze, it consists of 39.56 per cent of carbon, 7.69 hydrogen, and 52.75 oxygen, that is six equivalents of the first element, seven of the second, and six of the third ($C^6H^7O^6$).—The yellow nauseous extractive matter, observed first by Thenard and afterwards by Rose, is probably the product of slow decomposition, because the latter chemist found it to increase with age. Rose considers it to be the laxative principle of manna. Yet mannite is said by some to be as laxative as manna itself.

Adulterations.—A counterfeit manna is said to be sometimes met with, which is made of sugar, honey, and some mild cathartic. Its coarser qualities may perhaps be thus imitated with success; but it must be difficult to fabricate a substance with the external characters of Flake-manna. A sweet exudation somewhat similar to manna is obtained from various other trees, such as Brigantine or Briançon manna from the *Abies Larix*,—Manna Mereniabin from the *Hedysarum Alhagi* of Syria,—Manna of Lebanon from the *Larix Cedrus*,—Manna of Mount Sinai from the *Tamarix gallica*,

—and New-Holland manna from the *Eucalyptus mannifera.* The last of these, the only one of them in my possession, resembles the inferior kinds of common manna in tears; but is whiter.

Actions and Uses.—Manna is nutritive and laxative in its action. During the manna-harvest it is used as food in the countries where it is produced. It is one of the mildest of laxatives. Its operation is unattended with any local excitement or uneasiness; and it has therefore been long esteemed as a remedy during and after pregnancy, or for young infants,—in inflammation of the abdominal viscera, —and in the febrile disorders of childhood, especially wherever irritation prevails in the alimentary canal. Its reputation however has been for some time on the wane; and it is thought, not without reason, to have the disadvantage of disordering the functions of the stomach and exciting in some people flatulence and distension. It is now therefore seldom given alone. But it is often used for sweetening laxative mixtures, especially those containing infusion of senna. It forms part of the *Electuarium* or *Confectio sennæ.* It is also employed for extinguishing mercury in the preparation of the *Hydrargyrum cum creta* and *Hydrargyrum cum magnesia* of the Dublin College; and the same College directs it to be employed in making the *Enema catharticum.*

Its dose alone as a laxative is about two ounces.

MARANTA, *E. L. Fecula of the tubers of Maranta arundinacea, L. W. Spr. and Maranta indica, Tussac, Journ. Bot.—Spr. Arrow-root (Edin.)—Fecula of the Rhizoma of Maranta arundinacea (Lond.)*

FOR. NAMES.—The English name has been adopted in several European languages.—*Tam.* Kooamaoo.—*Hind.* Tikhur.

FIGURES of Maranta arundinacea in Nees von E. 69, 70.—Hayne, ix. 25.—Roscoe, Monandrous Pl. 25.

ARROW-ROOT has been long known in the West Indies, but has come into general use in this country only since the beginning of the present century. It is so named because the pulp of the root of the plant from which it is obtained was formerly employed by the natives of the West India islands as an application to wounds inflicted by arrows.

Natural History.—A substance presenting more or less the same characters with arrow-root may be obtained from the roots of many plants of various Natural families, but especially from the *Zingiberaceæ* and *Marantaceæ.* Amongst these may be mentioned *Zingiber officinale,* and *Z. Zerumbet, Curcuma Zerumbet, C. longa, C. leucorrhiza, C. angustifolia, Alpinia Galanga, Canna edulis* and *C. coccinea, Maranta arundinacea,* and *M. Indica,* as being all employed for the purpose in hot climates in various parts of the world. The arrow-root of English commerce however is understood to be derived from only three of these plants, *Maranta arundinacea, M.*

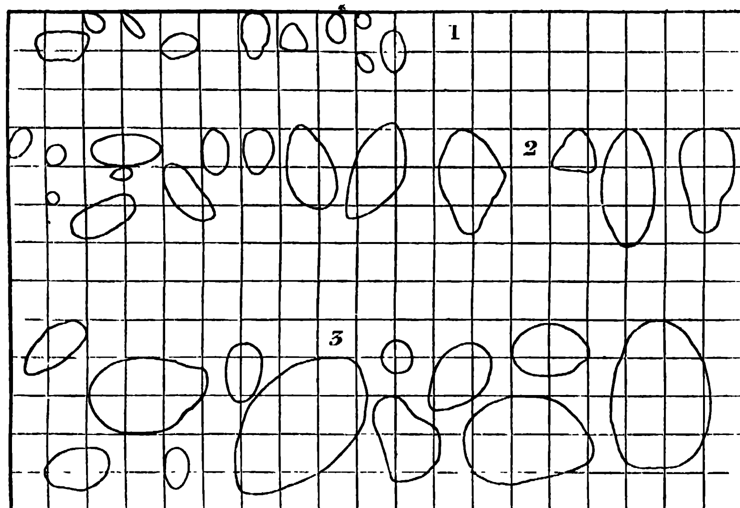
indica, and *Curcuma angustifolia*, and chiefly indeed from the first of them.

The *Maranta arundinacea*, now cultivated generally throughout the West Indies, was first transplanted into the English settlements from Dominica about the beginning of last century. It belongs to the Linnæan class and order *Monandria Monogynia*, and to the Natural family *Drimyrrhizeæ* of Decandolle or *Marantaceæ* of Lindley. It is a herbaceous plant about two, rarely four, feet high. It is propagated in Bermuda by planting portions of the root-stock, which is cylindrical, pointed, white, fleshy, and tapering downwards to the thickness of a goose-quill, and gives off numerous descending root-fibres. The portion planted gradually increases in size, and throws out leaves, which wither when the plant is mature. This occurs in about eight or nine months, and the root is then fit for yielding arrow-root. If the root remains longer in the ground it loses its simple form, throwing out young plants in the form of tubers (stolons), which also yield fecula (Cogswell). These tubers descend perpendicularly, then gradually bend till they assume an upright direction, and at length appear above ground (Nees and Ebermaïer). They are about a foot long and scarcely an inch in diameter, covered externally with large, thin, pointed scales, and in their substance white, fleshy, amylaceous, and bland. It does not appear, as has been supposed, that the rootlets ever expand into true tubers (Cogswell). Arrow-root is obtained from the various portions of the root by beating them into a pulp, stirring this in cold water, removing the fibres with the hand, passing the milky liquor through a fine sieve, allowing the starch to subside in the strained fluid, and then washing and drying it without heat. This constitutes West Indian arrow-root.——The *Maranta indica*, a native of the East Indies, differs so little from the former, that it is thought by some to be the same species. The only material differences between the two species are, that the leaves of the *M. indica* are more elongated at the point, and every where smooth, while those of *M. arundinacea* are hairy always on the lower surface, and sometimes also on the upper. The former probably supplies in the East a portion of what is imported into Britain under the name of East-Indian Arrow-root. But the chief part of that article is produced by a different species, the *Curcuma angustifolia*, a plant occurring generally throughout India, and abounding particularly on the Malabar coast, where starch is largely prepared from it (Sir W. Ainslie) by a similar process to that followed in the West Indies.

Chemical History.—West Indian Arrow-root is imported from various islands in the West Indies. That from Bermuda is most esteemed. Three qualities of it are met with, called First, Second, and Third, which differ in their whiteness, and slightly too in their odour and taste. The first quality is imported in soldered tin-boxes. The two others, being packed in barrels, are slightly co-

loured by the wood, and usually contract from it also a faint taste and odour. Arrow-root is a very pure variety of starch. It is composed partly of impalpable powder, but chiefly of irregular friable grains varying in size from a millet-seed to a pea. It crackles when rubbed between the finger and thumb. It is snow-white, faintly glistening, without odour, and almost tasteless. It consists of minute pearly globules, which are rarely spherical or ovate, generally elliptical, sometimes of the form of the lævigating muller, and of various sizes. Many are only a 2000th of an inch in their longest diameter, many are twice as long, and a few attain the 750th of an inch, but none are larger. Their breadth is generally two-thirds of their length.——Arrow-root presents all the chemical relations of wheat-starch (see *Amylum*). But it makes a much firmer jelly with the same quantity of boiling-water,—nine parts of arrow-root being equivalent in this respect to fourteen of common starch (Hayne). The jelly is tasteless. According to the analysis of Prout arrow-root is composed, when quite anhydrous, of 44.0 per cent of carbon, 6.22 hydrogen, and 49.78 oxygen, that is very nearly twelve equivalents of the first, ten of the second, and ten of the third ($C^{12}H^{10}O^{10}$). Consequently it corresponds in elementary composition with amylin, one of the principles of wheat starch.——East-Indian Arrow-root is described by Dr Pereira as commonly white, sometimes pale-yellow, less crepitating between the fingers than the best West-Indian kind, more frequently damaged by impurities, and composed of rather larger globules, unequal in size, egg-shaped, compressed, faintly rugous at their larger end, and with little processes attached to their sides. This sort is comparatively of low value, and is in request only among starch-makers (Pereira). A sample however sent to me in 1834 from Liverpool, and represented to have been obtained from the West-Indian plant cultivated in Bengal, exactly resembled Bermuda arrow-root, and presented the very same appearance before the microscope. The best sorts from the East-Indies, including that now mentioned, do not make so firm a jelly with boiling-water as the West-Indian kind.——Tahiti Arrow-root is an inferior kind prepared in Otaheite from the tubers of *Tacca pinnatifida*. The globules are more circular and smaller than in the other kinds. It has frequently a musty taste (Pereira). It is little seen in English commerce.

Adulterations.—West-Indian Arrow-root is often counterfeited by the substitution of the East-Indian variety, or potato-starch, or the starch of the *Canna coccinea* introduced not long ago into European commerce under the name of Tous-les-mois. The readiest mode of detecting these frauds is by means of a good microscope. The form and size of the West-Indian and East-Indian arrow-root have been already described, and are represented in the annexed sketch; in which 1. represents the globules of the finest West-Indian arrow-root,—2. those of Potato-starch prepared in my labo-



ratory,—and 3. those of Tous-les-mois from St Kitts,—all as seen through the microscope on a micrometer whose squares measure one-thousandth of an inch.

The globules of potato-starch are very unequal in size, elliptical for the most part, many of them a 500th or 400th of an inch in length, and some even so large as a 300th. The globules of Tous-les-mois are generally elliptical in form, many of them a 300th of an inch in length, and some even so much as a 200th. On account of the greater size of the globules of the last two varieties, they present to the naked eye a much more glistening appearance than arrow-root; and this character will alone distinguish them in the hands of an experienced person. Other methods besides the microscopic mode have been proposed for determining the genuineness of arrow-root: but they are either fallacious or too troublesome.——It is perhaps incorrect to speak of Tous-les-mois under the spurious arrow-roots. For, although cheaper at present in Britain than true arrow-root, it is more esteemed and dearer in some of the West-Indian islands; and from careful trials I am persuaded it is at least equal to arrow-root in every useful property.

Actions and Uses.—Arrow-root is nutritive and demulcent in its action. It may be used for all the medicinal purposes to which common starch is applied. But its chief consumption in medical practice is as an article of nourishment in chronic disorders, or the early period of convalescence from acute diseases, or for the dieting of infants. It is given in the form of jelly variously seasoned with sugar, fruit-jellies, essences or aromatics. No other variety of pure farinaceous food is so much in request in medicine at present, with the exception of tapioca. It seems superior to every other

kind but tapioca and tous-les-mois, because its jelly has no peculiar taste, is stronger than that of any other starchy substance, and is less liable to become acid in the stomach. Young infants generally show a decided preference for it over every other farinaceous food except tapioca. Potato-starch, which some substitute for it and consider scarely inferior, makes a looser jelly and is more apt to cause acidity, especially in infants. Tous-les-mois makes fully a stiffer jelly than arrow-root.

MARMOR, *E. L.* *Calcis carbonas.*

MARRUBIUM, *L. D.* *Herb of Marrubium vulgare, L. W. DC.* *White-Horehound.*

For. Names.—*Fren.* Marrube.—*Ital.* and *Span.* Marrubio.—*Port.* Marrojos.—*Ger.* Andorn.—*Dut.* Malrove.—*Dan.* Marrube.—*Russ.* Schandra belaia.

Figures of Marrubium vulgare in Nees von E. 174.—Engl. Bot. 410.—Steph. and Ch. iii. 135.

White-Horehound, the Πρασιον of Dioscorides and prior Greek physicians, though used in medicine from a very remote era, is now abandoned in regular practice, and has accordingly been expunged from the last edition of the Edinburgh Pharmacopœia.

It belongs to the Natural family *Labiatæ*, and to the Linnæan class and order *Didynamia Gymnospermia.* It is a native of this country, of the continent of Europe, of the middle regions of Asia, and also of North America. It is found on dry sandy fields, road-sides, and banks of rubbish. It may be distinguished from other Labiatæ by its tetragonal stems, its petiolated, roundish, coarsely-notched leaves, and the white hoary appearance of the whole plant. It flowers in July and August, and should be collected about the commencement of inflorescence. It has a peculiar and rather agreeable, vinous, balsamic odour, and a very bitter, aromatic, somewhat acrid taste. Like other plants of the same family it owes its properties to a volatile oil and a bitter extractive matter.

It has been immemorially held a tonic and expectorant, and peculiarly fitted for the treatment of chronic coughs of all kinds. But it is now used only in domestic practice. It is given in the form of infusion, extract, and syrup.

MASTICHE. *Concrete resinous exudation* (*Resin, L. D.*) *of Pistacia Lentiscus, L. W. DC. Spr.* *Mastich.*

For. Names.—*Fren.* Mastic.—*Ital.* Mastice.—*Span.* Almaciga.—*Port.* Almacega da India.—*Ger. Swed.* and *Dan.* Mastix.—*Dut.* Mastik ; Stopwerv.—*Arab.* Arah ; Auluk bagdadie.—*Pers.* Kinneh.—*Tam.* Roomic mustiki.

Figures of Pistacia Lentiscus in Nees von E. 351.—Hayne, xiii. 20.—Steph. and Ch. iii. 130.

This resin is the Μαστιχη or 'Ρητινη σχινινη of the ancient Greeks.

Natural History.—The tree which produces it is the *Pistacia Lentiscus*, a plant of the Linnæan class and order *Diœcia Pentandria*, and of the Natural family *Terebinthaceæ*. It inhabits the coasts and islands of the Mediterranean, and abounds particularly on the Island of Chios, where it is much cultivated for the sake of its resin. It is a bush about twelve feet high. Mastic is produced by it spontaneously, or from incisions made into the bark during the month of August. It is imported into Britain from the Grecian Archipelago. There are two qualities of it in commerce, called Picked Mastic, and Mastic in sorts. The former is in tears varying in size between a pepper-corn and hazel-nut, roundish or elongated, often flattened, pale-yellow and translucent, but usually covered with a whitish dust from attrition, brittle and easily pulverized, glassy in fracture, and of a faint, agreeable, balsamic odour and taste. The coarser kind, termed Mastic in sorts, is impure, and presents many tears of a grayish-brown or black colour, as well as fragments of wood, bark, and sand.

Chemical History.—Mastic when chewed becomes soft, ductile, gray and opaque. It melts at a moderate heat, and burns at a higher temperature with a clear flame and balsamic fumes. It is insoluble in water, but entirely and easily soluble in ether, oil of turpentine, or boiling alcohol. Boiling rectified spirit dissolves from it a resinous acid to the amount of nine-tenths of its weight, and leaves a white, ductile substance, which is soluble in ether or boiling absolute alcohol, and which some have considered a peculiar principle under the name of Masticin. Mastic also contains a trace of volatile oil.

Adulterations.—The finer kind of mastic is sometimes adulteratd with Sandarach, the resinous exudation of the *Thuya articulata*. This fraud is easily detected; for the tears of sandarach are more elongated, do not become soft and ductile when chewed, and are with difficulty dissolved in oil of turpentine (Geiger).

Uses.—Mastic is much employed in Turkey as a masticatory for consolidating the gums, cleaning the teeth, and sweetening the breath. It is occasionally used in substance, or in the form of a strong solution in spirit, for stuffing decayed teeth, and also as an excipient for making pills. Its chief consumption however in this country is for compounding varnishes. It forms part of the London *Tinctura ammoniæ composita*, which is equivalent to the nostrum called Eau de luce, at one time in high esteem as an antispasmodic.

MEL, *E. L. D. Saccharine secretion of Apis mellifica* (*Edin.*) *A liquid gathered from flowers and prepared by the Bee* (*Lond.*) *Honey.*

TESTS, *Lond.* Honey should be clarified by despumation before being used. A watery solution is not rendered blue by iodide of potassium added along with an acid.

MEL DESPUMATUM, D.

PROCESS. Liquefy honey in the vapour-bath, and remove the scum.

FOR. NAMES.—*Fren.* Miel.—*Ital.* Mele.—*Span.* Miel.—*Port.* Mel.—*Ger.* Honig.—*Dut.* Honig.—*Swed.* Honung.—*Dan.* Honning.—*Arab.* Ussel ulnehl; Mudhoo.—*Pers.* Shahid.—*Tam.* Tayn.

• *Natural History.*—THE *Apis mellifica* or Honey-bee is a native of various parts of the Old World. It belongs to the order *Hymenoptera* of the class of insects. In the wild state it dwells in the hollows of trees in large communities, consisting of females, males, and neuters. Honey is collected by the neuters only, which suck it with their proboscis from the nectaries of flowers into a proper receptacle, and discharge it into the cells of the honeycomb somewhat altered in its sensible qualities. It is obtained from the honeycomb by dripping the flakes in the sunshine; and when this process comes to an end, an inferior quality is got by expression or by fusion in the vapour-bath. The former, which is alone applicable to medical purposes, is sometimes called Virgin-honey; but this name is properly applied solely to what is obtained by dripping honeycomb from a hive of young bees before they have swarmed.

Chemical History.—Fine honey is at first fluid, thick, viscid, colourless or of the palest straw tint, of a peculiar fragrant odour, and of a corresponding aromatic, very sweet taste. When long kept, it becomes concrete from the formation of numberless granular crystals. Its flavour, and consequently its quality, vary with the kind of flowers to which the bees have access. When of inferior quality it is brownish, bitterish, and prone to putrefaction; which properties are commonly ascribed to its having been detached from the comb with the aid of pressure, and being consequently impregnated with what is called bee-bread. This impure sort may be improved by the process of despumation, as enjoined by the Pharmacopœias; but the process is scarcely necessary, if fine honey be used. The most effectual mode of purifying honey, is to boil it gently with a third of its volume of water and a sixteenth of its weight of ivory black, not too finely powdered,—to let the grosser particles of charcoal subside, and remove the rest by filtration through flannel,—to clarify the liquor with white of egg,—and to concentrate the filtered liquid over the vapour-bath to the due consistence (Schmidt). Honey is in a great measure soluble in water. Boiling alcohol also dissolves it, and on cooling deposits crystals of grape-sugar. It is composed of crystallizable grape-sugar, uncrystallizable sugar, and probably a little unfermentable mannite. The greater part of it undergoes the vinous fermentation with yeast, and yields an alcoholic liquor called mead. Honey is sometimes adulterated with starch, which may be discovered by tincture of iodine or the method recommended by the London College. In some countries, especially the Chersonesus, and some parts of North and South America, it is rendered noxious by the bees sucking poisonous flowers.

It is now little used in medicine. It is a useful addition to some gargles, and serves well to season certain diet-drinks. In the *Mel rosæ*, *Mel boracis*, *Oxymel simplex*, and *Oxymel scillæ*, it answers the purpose of syrup.

MELALEUCA LEUCODENDRON, *D.* See *Cajuputi Oleum.*

MELISSA, *E. L. D.* *Herb of Melissa officinalis, L. W. Spr. Balm.*

FOR. NAMES.—*Fren.* Citronelle.—*Ital.* Cedronella ; Melissa.—*Span.* and *Port.* Melissa.—*Dut.* Citronenkruid ; Melisse.—*Ger.* Gemeine melisse ; Citronenkraut.—*Swed.* Meliss.—*Dan.* Hiertensfryd.—*Russ.* Melissa autetschnaia.

FIGURES of Melissa officinalis in Nees von E. 180.—Hayne, vi. 32.

THIS plant was the Μελισσοφυλλον or Μελιταινα of Dioscorides, and was so named from the fondness of bees for its flowers.

Natural and Chemical History.—It belongs to the Linnæan class and order *Didynamia Gymnospermia*, and to the Natural family *Labiatæ*. It is a native of most parts of southern Europe, and as far north as Switzerland and Austria, where it is found in the wooded parts of hills. It is much cultivated in English gardens on account of its grateful perfume. It is easily known from other labiate plants by its leaves, which are cordate or ovate, somewhat hairy above, but smooth beneath, and possessed of a powerful and agreeable citron fragrance. It has an aromatic bitter taste, with slight astringency, and considerable, persistent bitterness. Its odour is preserved in the dried leaves, if the desiccation be performed quickly; but they lose it in time. Balm contains a bitter extractive matter, a little tannin, and a peculiar volatile oil, which is pale yellow, very liquid, 975 in density, and of the same agreeable citron odour with the plant itself. A pound of the plant yields only four grains of this oil.

Sometimes the *Nepeta citriodora* is cultivated and used in medicine by mistake for this plant (Geiger). It has the same odour, but is easily distinguished by having both surfaces of its leaves hairy, while those of *Melissa* are hairy above only and smooth underneath.

Actions.—Balm in the form of infusion or tea is a good deal used in some parts of England in domestic practice as a stimulant carminative; and in ancient times it was esteemed as a local application to strumous ulcers and poisoned wounds, and internally as an emmenagogue. But it is now abandoned in regular practice in this country. Several preparations of it are in use abroad, as the infusion, spirit, syrup, and volatile oil.

MENTHA PIPERITA, *E. L. D.* *Herb of Mentha piperita. L. W. Spr.* (*Smith, Linn. Trans.* Lond.) *Peppermint.*

MENTHAE PIPERITAE OLEUM, *E.* *Volatile oil of Mentha piperita, &c.*

AQUA MENTHAE PIPERITAE, E. L. D.

PROCESS, *Edin.* To be prepared like *Aqua menthæ viridis.*
PROCESS, *Lond.* Take of
Dried peppermint, two pounds; or oil of peppermint, two drachms;
Proof spirit, seven fluidounces;
Water, two gallons.
Distil off a gallon.
PROCESS, *Dub.* Take of
Peppermint, one pound and a-half;
Water, enough to prevent empyreuma.
Distil off one gallon.

OLEUM MENTHAE PIPERITAE, E. L. D.

PROCESS, *Edin. Lond. Dub.* To be prepared from peppermint, according to the general directions for obtaining Volatile oils. See *Introduction.*

SPIRITUS MENTHAE PIPERITAE, L. D. SPIRITUS MENTHAE, E.

PROCESS, *Edin.* Take of
Fresh peppermint, a pound and a-half.
Proceed as for Spirit of caraway.
PROCESS, *Lond. Dub.* Take of
Oil of peppermint, 3 (4, D.) drachms;
Water, a pint (enough to prevent empyreuma, D.);
Proof-spirit, a gallon.
Mix and distil off one gallon with a gentle heat.

FOR. NAMES.—*Fren.* Menthe poivrée.—*Ital.* Menta piperita.—*Span.* Jerbabuena de pimienta.—*Port.* Hortelá apimentada.—*Ger.* Pfefferminze.—*Dut.* Peperminte.—*Swed.* Pepparmynta.—*Dan.* Pebermynte.—*Russ.* Miata peretschnaia; Miata angliskaia.

FIGURES of Mentha piperita in Nees von E. 165.—Hayne, xii. 37.—Engl. Bot. 687.—Roque, 50.—Steph. and Ch. i. 45.

Two species of mint were used by the ancient Greek physicians, which were called 'Ηδυοσμος 'ημερος or Μινθη, and Καλαμινθη. But it is doubtful whether either of these is the modern peppermint. It came into general use in the medicine of western Europe only about the middle of last century, and in the first instance in England.

Natural History.—Peppermint, the *Mentha piperita* of botanists, is an indigenous plant, with a perennial root and an annual herbaceous stem. It belongs to the Linnæan class and order *Didynamia Gymnospermia*, and to the Natural family *Labiatæ.* It is extensively cultivated in this and other European countries for the sake of its oil. It flowers from July to September. The officinal part is the herb, which should be collected when the flowers have begun to blow. The whole herb has a powerful, penetrating, diffusive, aromatic odour, and a rather agreeable, somewhat camphoraceous taste, attended at first with a sense of warmth, but afterwards with a singular and durable feeling of coldness in the mouth during inspiration. These properties are owing to a volatile oil, which is contained in little vesicles existing throughout the plant, and visible in the leaves. Both the odour and taste are retained in a great measure when the plant is dried, and may be preserved afterwards for a long time.

Chemical History.—The herb, both in its fresh and dried condition, yields its properties by distillation to water and spirit; and when water is used, volatile oil also passes over undissolved. In this way are obtained the *Aqua, Spiritus,* and *Oleum menthæ piperitæ* of the Pharmacopœias. Fresh leaves yield the largest quantity and best quality of these preparations; but in practice dried

leaves are often substituted for convenience in making the first two; and the spirit is also prepared by many with the oil instead of the herb, as in the process of the London and Dublin Colleges. Peppermint contains a little tannin, as its infusion becomes dark-green with the salts of sesquioxide of iron; but the chief ingredient is its volatile oil.

Oil of peppermint is obtained from the herb, in the proportion of a 200th (Hagen) or 320th (Pereira) part, by distilling it along with water. English oil is most esteemed. It is colourless when recently distilled, or very pale greenish-yellow; but it becomes yellower or even reddish with age. In fragrance and taste it resembles the plant itself; and its odour is more penetrating than that of almost any other oil obtained from plants inhabiting cold countries. When cooled down to −12°, or evaporated spontaneously, or gently distilled from solution of carbonate of potash, crystals of stearoptin are obtained; but in some samples from North America these separate in small quantity at ordinary temperatures in this country; and I have a variety from Canton, called there Po-ho-yo, which so abounds in stearoptin as to form a uniform soft solid mass even in summer. When separated by pressure, this stearoptin is obtained in white delicate needles, which in a roomy bottle evaporate spontaneously, and condense on the glass in splendid arborescent crystallizations. That of American peppermint fuses at 80°.5. The density of peppermint oil is 899 (Pereira) or 920 (Thomson). It boils at 365°. According to Blanchet and Sell it consists of 78.5 per cent of carbon, 11.01 hydrogen, and 10.49 oxygen ($C^{12} H^{10} O$); and its stearoptin contains two equivalents less of carbon. Kane however has found the composition of the oil to be $C^{25}H^{22}O^{2}$.

Adulterations.—Peppermint and its oil are not subject to adulteration. The plant is sometimes confounded with the *Mentha viridis* or spearmint; but the latter is easily distinguished by its leaves being sessile or nearly so, while those of peppermint have leaf-stalks.

Actions and Uses.—Peppermint is in its action a powerful diffusible stimulant, and as such also antispasmodic, carminative and stomachic. It is one of the most efficacious of carminative remedies, and is therefore much employed in the treatment of gastrodynia and flatulent colic. It is also extensively used in mixtures for covering the taste of other drugs or preventing their nauseating influence on the stomach. An infusion is at times used in domestic practice. The distilled water and spirit are its best officinal preparations. Another good form is a stronger spirit, not recognized by the Colleges, but in general use under the name of Essence of peppermint, which consists (Pereira) of one part of the oil dissolved in eight parts of rectified spirit.

The doses of its preparations are: *Aqua menthæ piperitæ*, fl.unc. i.

ad fl.unc. ii—*Spiritus menthæ piperitæ*, min. xxx. ad fl.dr. i.—*Oleum menthæ piperitæ*, min. ii. ad min. v.

MENTHA PULEGIUM, *L. D.* PULEGIUM, *E.* *Herb of Mentha Pulegium, L. W. Spr.*—*Pennyroyal.*

AQUA MENTHAE PULEGII, E. L. D. OLEUM MENTHAE PULEGII, E. L. D. SPIRITUS MENTHAE PULEGII, L. D.

PROCESS, *Edin. Lond. Dub.* To be prepared with pennyroyal in the same manner as the corresponding preparations of *Mentha piperita.*

FOR. NAMES.—*Fren.* Pouliot.—*Ital.* Puleggio —*Span.* Poleo.—*Port.* Poejos. —*Ger. Dut.* and *Dan.* Poley.—*Swed.* Poleja.—*Russ.* Polei ; Miata serletschnaia.

FIGURES of Mentha Pulegium in Nees von E. 167 —Engl. Bot. 1026.—Steph. and Ch. i. 45.—as Pulegium vulgare in Hayne, xi. 39.

THIS species of mint is supposed to have been the Γλήχων of the ancient Greeks and the *Puleeium* or *Pulegium* of the Romans.

Natural History.—It is rather extensively diffused, being found in ditches and moist meadows in most parts of Europe, in Asia, on Mount Caucasus, in the South-American province of Chili, and on the island of Teneriffe (Lindley). It belongs to the Linnæan class and order *Didynamia Gymnospermia,* and to the Natural family *Labiatae.* It has a creeping perennial root, and an annual herbaceous stem. It is known from most other species of mint by its small, petiolated, blunt-pointed leaves, seldom exceeding half an inch in length. The *M. arvensis,* which otherwise resembles it, has more hairy and much larger leaves. The officinal part is the herb, which is collected while the plant is in flower. It has a strong penetrating rather disagreeable odour, and a bitterish aromatic rather rough taste; both of which properties are in some measure retained by the dried plant. It contains a little tannin, and a volatile oil. The latter passes over in distillation with water or with spirit, producing the *Aqua, Oleum, and Spiritus menthæ pulegii* of the London and Dublin Pharmacopœias.

Pennyroyal has been considered a good pectoral and antispasmodic in chronic coughs and asthma, a powerful emmenagogue, and an efficacious anti-arthritic remedy. It is now with justice held identical in action, or nearly so, with other mints, and inferior for all purposes to peppermint; which since the middle of last century has displaced it in regular practice, and confined it chiefly within the limits of domestic medicine. It has been supposed to possess the power of driving away fleas; whence its modern specific name, as well as its ancient Roman designation.

The doses of its preparations are *Aqua menthæ pulegii,* unc. i. ad unc. ii.—*Oleum menthæ pulegii,* m. i. ad m. v.—*Spiritus menthæ pulegii,* dr. i. ad dr. iv.

MENTHA VIRIDIS, *E. L. D.* *Herb of Mentha viridis, L. W Spr.—Spearmint.*

AQUA MENTHAE VIRIDIS, E. L. D.

PROCESS, *Edin.* Take of
Spearmint, four pounds if fresh, two pounds if dry;
Water, two gallons;
Rectified-spirit, three fluidounces.
Mix them, and distil off one gallon.

PROCESS, *Lond. Dub.* To be prepared as *Aqua menthæ piperitæ.*

INFUSUM MENTHAE, D.

PROCESS, *Dub.* Take of
Dried Spearmint, two drachms;
Boiling water, enough to make six ounces of filtered infusion.

INFUSUM MENTHAE COMPOSITUM, D.

PROCESS, *Dub.* Take of
Dried spearmint, two drachms;
Boiling-water, enough to make six ounces by measure of filtered infusion. Digest for half an hour in a covered vessel; strain the liquor when cold; and then add of Pure Sugar two drachms;
Spearmint-oil, three drops, in
Compound Tincture of Cardamom, half an ounce.

OLEUM MENTHAE VIRIDIS, E. L. D.

PROCESS, *Edin. Lond. Dub.* To be prepared according to the general directions for obtaining Volatile oils. See *Introduction.*

SPIRITUS MENTHAE VIRIDIS, L. D.

PROCESS, *Lond. Dub.* To be prepared from spearmint in the same way as *Spiritus menthæ piperitæ.*

FOR. NAMES.—*Fren.* Menthe verte.—*Ital.* Erba Santa Maria.—*Ger.* Römische münze.—*Dut.* Gröne munt.

FIGURES of Mentha viridis in Nees von E. 166.—Hayne, xi. 36.—Engl. Bot. 2424.—Steph. and Ch. i. 15.

IT is uncertain whether the *Mentha viridis* of present botanists was one of the mints used in ancient times or not (see *Mentha piperita*); but it has been very long an article of the modern Materia Medica.

Natural and Chemical History.—It belongs to the Natural family *Labiatæ*, and to the Linnæan class and order *Didynamia Gymnospermia.* It grows naturally in the British Isles, throughout the European continent, in North and South America, and on the Canary Isles; and it thrives in ditches, damp meadows, and moist woods. It has a perennial creeping root, which pushes up annually several herbaceous stems. It closely resembles Peppermint; from which however it may be distinguished by its leaves being more obviously lanceolate, more pointed, and less distinctly petiolated, and by the stamina being considerably longer, so as to project beyond the corolla. The officinal part is the herb, which is collected while in flower. It has a strong, rather agreeable odour, little different from that of peppermint, but feebler, and a similar, though weaker, aromatic taste, followed by coolness in the mouth during inspiration. It contains about a 500th part of a pale-yellow volatile oil, which passes over in distillation with water or spirit, so as to constitute the *Aqua, Oleum,* and *Spiritus menthæ viridis* of the Pharmacopœias. Its virtues are also extracted by infusion with

water; and in this way are obtained two Dublin preparations, the *Infusum menthæ simplex*, and *Infusum menthæ compositum*, the latter of which is rendered more stimulating with compound tincture of cardamom.

Uses.—The actions and uses of spearmint are identical with those of peppermint, but it is less energetic; so that it may be dispensed with. There seems no foundation for the opinion long currently entertained that it repels the secretion of milk.

The doses of its preparations are like those of peppermint.

MENYANTHES, *E. L. D.* *Leaves of Menyanthes trifoliata, L. W. Spr.* *Buckbean.*

FOR. NAMES.—*Fren.* Menyanthe; Trèfle d'eau.—*Ital.* Meniante.—*Span.* Trifolio palustre.—*Port.* Trevo dos charcos.—*Ger.* Fieberklee; Zottenblume.—*Dut.* Driebladige ruigbloem.—*Swed.* Vattuklöfver.—*Dan.* Vandklever.—*Russ.* Bachta trilistnaia; Trilistnik vodianoi.

Menyanthes trifoliata figured in Hayne, iii. 14.—Nees von E. 201.—Engl. Bot. 495.—Steph. and Ch. ii. 85.

THE Bog-bean, Buck-bean, or Marsh-trefoil has been long used in European medicine, but is now little employed in this country except in domestic practice.

It belongs to the Linnæan class and order *Pentandria Monogynia*, and to the Natural family *Gentianaceæ*. It abounds in boggy grounds in the British Isles, on the continent of Europe, and in North America; and is easily known by its ternate, bitter leaves. It produces from May to July an erect cluster of beautiful, feathery flowers, of a pale lilac colour, and is one of the most beautiful of indigenous flowering plants. The leaves, its officinal part, are very bitter, somewhat aromatic to the taste, but without odour; and the bitterness is preserved in the dried plant. They contain a bitter extractive matter, chlorophyll, a little albumen, and a trace of tannin (Trommsdorff).

The bog-bean possesses the properties of the family of plants to which it belongs, being tonic, stomachic and febrifuge. On account of these actions it is still given for dyspepsia in domestic practice; and when agues were frequent in Scotland, it was in common use as a febrifuge. It is said also to be a cathartic in doses of a drachm; and in larger doses it is held to be an emetic. Some physicians believe it is unjustly neglected at present. It is given either in powder to the extent of a scruple as a tonic, or a drachm as a laxative, or in the form of infusion prepared with an ounce to a pint of water.

MEZEREON, *E.* MEZEREUM, *L.* CORTEX DAPHNES MEZEREI, *D.* *Root-bark (Bark, D.) of Daphne Mezereum, L. W. Spr.* *Mezereon.*

DECOCTUM MEZEREI, D.

PROCESS, *Dub.* Take of Mezereon-bark, two drachms;

Bruised liquorice root, half an ounce ; Water three old wine pints. Boil to two pints and strain.

FOR. NAMES.—*Fren.* Bois gentil ; Mezereon.—*Ital.* Laureola femina ; Biondella.—*Span.* Mecereon ; Laureola hembra.—*Port.* Loireola femea ; Mezereão.—*Ger.* Seidelbast ; Kellerhals.—*Dut.* Peperboomje —*Swed.* Tibast.—*Dan.* Kielderhals ; Tisbast.—*Russ.* Boltschnik : Jagolki voltschi.

Daphne Mezereum figured in Nees von E. 125.—Hayne, iii. 43.—English Bot. 1381.—Steph. and Ch. ii. 65.

UNDER the names Χαμελαια and Θυμελαια, which are often used synonymously by the ancient Greeks, Dioscorides distinguished two species of plants, one of which, and most probably the former, was the mezereon of the modern Materia Medica.

Natural History.—The *Daphne Mezereum* is a common inhabitant of shady woods throughout central and northern Europe, as well as the northern parts of Asia. It is a doubtful native of this country. It belongs to the Natural family *Thymelaceæ*, and to the Linnæan class and order *Octandria Monogynia.* It is a small shrub, which is generally cultivated in gardens and shrubberies both on account of its beautiful, fragrant, pink flowers, and also for the splendid clustered scarlet berries which succeed. The flowers blow in March, and the berries ripen in midsummer. The whole plant is very acrid, but especially the berries and bark of the root. The officinal part on the continent, and also according to the Dublin Pharmacopœia, is the bark of the trunk and branches; but the other British Colleges prefer the more active root-bark. Mezereon-bark is usually collected in the spring. It is met with in the shops in the form of thin flat or quilled pieces, tough and fibrous, of an olive or brownish hue on its outer surface, yellowish-white within, of a faint unpleasant odour when fresh, and of a sweetish taste, followed soon by intense and durable hot acridity. The fresh or moist bark, applied to the skin, causes redness and vesication.

Chemical History.—Water and rectified spirit dissolve out its active part. The former menstruum is employed for preparing the *Decoctum Mezerei* of the Dublin Pharmacopœia, now little used. The active part of the bark may be also united with oils or fats; and in this way an excellent issue ointment may be obtained. By macerating five parts of coarsely-powdered bark in four parts of tepid water, then bruising it and replacing it in the water, boiling the whole with ten parts of olive oil till the water is expelled, and lastly mixing the filtered oil thoroughly with four parts of melted wax, a green ointment is produced, which is said to be much more efficacious as an issue ointment than the corresponding preparation of savin commonly used in this country.—The bark of the stem and branches has been analysed by Gmelin and Baer, and found to contain a great variety of principles, among which the most important are sugar, wax, free and combined malic acid, yellow colouring matter, a neutral crystalline principle called Daphneïn, analogous to Asparagin, and an acrid resin. The last principle

is considered by them to be the active ingredient of the plant. Vauquelin obtained at an earlier period from another species of the same genus, the *D. alpina*, a principle similar to the daphneïn of the German chemists, and an acrid volatile oil, which slowly passes to the state of a resin. Celinsky found the seeds of the plant to consist chiefly of albumen, gluten, and an acrid concrete oil (Geiger).

Adulterations.—Mezereon-bark can scarcely be said to be subject to adulteration. The barks of other species of *Daphne*, such as *D. Gnidium*, *D. alpina*, *D. Cneorum*, and *D. Laureola*, are sometimes substituted for the true bark; but as they are all acrid, the substitution is of no great consequence except in the case of our native evergreen species, the *D. Laureola*, which is much inferior in energy to the others.—Some druggists use the whole root instead of the bark only; but this is an error, since the wood is feebly acrid.

Actions and Uses.—In its action mezereon is an irritant and stimulant, a cathartic, and also, as some think, diuretic and diaphoretic. In large doses it is a dangerous irritant poison, causing redness and vesication of the skin when left some time in contact with it, and exciting when swallowed dryness and burning of the throat, vomiting, hypercatharsis and occasionally also symptoms of irritation of the kidneys. Children have been killed by eating the berries. Yet in some countries they are used to the amount of eight or ten as a purgative. The bark is sometimes applied externally in substance for blistering the skin; for which purpose it is cut into squares, moistened and bound over the part. Or it is used in the form of some such ointment as that described above, for keeping up a discharge from a blistered surface. Internally, it has been much used as a part of the many composite diet-drinks employed in the treatment of syphilis and mercurio-syphilis. Many have considered it an essential ingredient of these remedies; and the British Colleges have so far adopted this opinion as to have admitted it into the well known preparation, the *Decoctum sarzæ compositum.* As a diaphoretic, this preparation, or the simple mezereon-decoction, is at times serviceable in chronic cutaneous diseases.

The dose of its only preparation, the *Decoctum mezerei*, D. is fl.unc. iv. repeatedly in the day.

MOMORDICA ELATERIUM, *D.* See *Elaterium.*

MORA, *L.* BACCAE MORI NIGRAE, *D.* *The fruit (Berries, D.) of Morus nigra, L. W. Spr.—Mulberries.*

SYRUPUS MORORUM, L.

PROCESS, *Lond.* Take of
Mulberry-juice, strained, a pint;
Sugar, two pounds and a half.

Dissolve the sugar in the juice with a gentle heat, and proceed as for *Syrupus Limonum.*

FOR. NAMES.—*Fren.* Mures.—*Ital.* Gelso nero.—*Span.* Moras.—*Port.* Amora.—*Ger.* Maulbeer.—*Dut.* Moerbeer —*Swed.* Mulbär.—*Dan.* Morbär.

FIGURES of Morus nigra in Nees von E. 100,—Hayne, xiii. 16,—Steph. and Ch. i. 39.

THE MULBERRY has been used as an eatable fruit, and likewise in medicine, almost immemorially. The tree is the Μορεα or Συκαμινεα, and the fruit the Μορον, of Dioscorides.

The *Morus nigra* belongs to the Linnæan class and order *Monœcia Tetrandra*, and to the Natural family *Urticaceæ*. It is a low tree, which is believed to have come originally from Persia, but is now disseminated by cultivation over many parts of Asia and Europe, and among the rest throughout England. The fruit, its officinal part, consists of a dense cluster of female flowers, which become fleshy, grow together, and passing from green to red, assume finally a deep purple colour, and ripen during August and September. It has a faint peculiar odour, and a pleasant, sweetish, subacid taste. It abounds in a deep purple juice, the taste and flavour of which may be preserved a long time in the form of the London *Syrupus Mororum*. It has not been hitherto analyzed with care; but its acidity appears to be owing to tartaric acid.

In its action the mulberry is nutritive, if taken in moderation; but in excess it tends to induce diarrhœa. The syrup may be used for making a pleasant drink in febrile diseases; and it is employed for imparting colour and flavour to some extempore prescriptions. The Colleges however might all follow without great detriment the example of that of Edinburgh, by which this fruit has been expunged from their Pharmacopœia.

MORPHIA, *L.* *Morphia.*

TESTS, *Lond.* Soluble scarcely in cold water, slightly in boiling water, readily in rectified spirit. This solution turns turmeric brown, and yields by evaporation crystals entirely destructible by heat. Nitric acid first reddens it and then renders it yellow. Tincture of sesquichloride of iron makes it blue. Chlorine, with the addition of ammonia, renders its salts brown, but in excess removes the colour. It is precipitated from solutions of its salts by solution of potash; which, added in excess, redissolves it.

PROCESS, *Lond.* Take of
Hydrochlorate of morphia, an ounce;
Solution of ammonia, five fluidrachms;
Distilled water, a pint.
Add the hydrochlorate of morphia dissolved in a pint of water to the solution of ammonia diluted with an ounce of water; and agitate. Wash the precipitate with distilled water and dry it with a gentle heat.

FOR. NAMES.—The name *Morphine*, first used in France, has been adopted in most continental languages.

MORPHIA, the chief active principle of opium, and the first of the alkaloids extracted from vegetable substances, was discovered in 1817 by Sertuerner. Robiquet however was the first who accurately determined its nature. It is itself little employed in medicine, being commonly used in the form of a neutral salt.

Chemical History.—It may be obtained from opium indirectly, as the London College has indicated, by first preparing the muriate

of morphia, and then decomposing that salt by one of the ordinary alkalis. Or it may be prepared directly from the drug itself by a variety of processes, which have been variously preferred by different experimentalists for their supposed facility or productiveness. The essential step of every process is decomposition of the salt of morphia in opium by the superior affinity of an inorganic alkali or alkaline earth for its acid. The method first employed by Robiquet consists in preparing a cold infusion of opium,—decomposing it when cold with ammonia or by ebullition with magnesia,—dissolving out much of the resinoid matter and narcotin in the precipitate with a little boiling proof-spirit,—exhausting the residue with boiling rectified spirit, which is subsequently in part distilled off, so that crystals of morphia, with a little narcotin, form on cooling,—and then purifying the morphia by repeated crystallization, and the decolorizing agency of animal charcoal.——A more recent method, suggested by Merck, which is said to be more productive, and which possesses the advantage of saving spirit as well as frequent crystallizations, consists in decomposing a concentrated infusion with a large excess of carbonate of soda unaided by heat,—and purifying the precipitated morphia by repeated crystallization from alcohol and the action of animal charcoal.——A third process, that of Mohr, has the advantage of not requiring spirit at all. It consists in pouring a boiling-hot infusion of opium into an excess of boiling-hot milk of lime in the proportion of four parts of lime to every sixteen of opium originally used,—continuing the ebullition for a few minutes, filtering and concentrating the fluid, and then boiling it with one part of muriate of ammonia till ammonia ceases to be disengaged. Morphia is thus easily obtained in a state of moderate purity; and according to Mohr, it may be purified completely without either spirit or animal charcoal by forming it into a salt with muriatic acid, and treating this salt in the same way as the opium. The material actions in this ingenious process are, that the excess of lime, while it redissolves the morphia, which in less proportion it would precipitate, does not redissolve narcotin or colouring resinoid matter,—and that the muriate of ammonia, decomposed by the excess of lime in the filtered fluid, forms muriate of lime, and thus removes the cause of the morphia being kept in solution.——Much has been said of the superiority of the processes of Merck and Mohr in point both of productiveness and facility. After trying both, they have appeared to me inferior in both respects, but especially in facility, to the method generally pursued in this country since the investigations of Dr William Gregory, and now substantially adopted by the London College. The details of the process for obtaining muriate of morphia, with its own peculiar advantages, will be found under the head of that salt. The subsequent step, in which the weaker *Aqua Ammoniæ* (960 dens.) is added to a solution of the salt in water, is a case of simple decomposition.——According to another method still more lately

recommended by Merck, opium is boiled with sixteen times its weight of proof-spirit, and the residuum boiled again with half that quantity. The filtered liquors, being next treated with half a part of carbonate of soda, are evaporated to dryness, and the residuum is washed with cold water, then soaked with two parts of rectified-spirit (dens. 850), and washed on a filter with a little more spirit. The powder left is now dried and dissolved in one part of distilled vinegar, diluted with its own volume of water; and after filtration, the matter not acted on is treated with half the previous proportion of acid. The liquors thus obtained are united and decomposed with ammonia and brisk agitation. This method is said to yield from 12 to 16 per cent of pure morphia.

Morphia prepared by the London process, is in the form of a snow-white, obscurely crystalline powder. It has an intensely bitter taste, which is slowly developed, on account of its insolubility. Boiling water dissolves only a 500th of its weight of it, and on cooling deposits it almost entirely in minute spiculæ. Boiling rectified spirit dissolves a 30th of its weight, and on cooling deposits the greater part in little brilliant crystals, which are said to be sometimes rectangular or rhombic prisms, but which I have constantly found to be somewhat flattened six-sided prisms, obviously derived from the latter form. Ether and the fixed and volatile oils dissolve it sparingly. The alcoholic solution renders red litmus purple and turmeric brown. A temperature about 250° expels 6.33 per cent of water from crystallized morphia. A heat somewhat higher fuses it; and on cooling, it becomes a radiated crystalline mass somewhat discoloured from partial decomposition; and a still higher heat destroys it with the disengagement of smoky vapours, having a peculiar odour like that of truffles. Morphia dissolves readily in diluted acids, neutralizes them, and forms salts which are for the most part soluble, permanent, and crystallizable. Two of these, the muriate and acetate, are much used medicinally in this country, and others are employed abroad. Concentrated nitric acid added to morphia occasions effervescence from the discharge of nitrous acid; and there is produced a deep orange crystalline substance, which by the further addition of acid is converted into a sulphur-yellow fluid. Solution of iodic acid is rendered brown by morphia, owing to the disengagement of iodine. Solution of potash dissolves its powder, and, when neutralized, parts with it again unchanged. Lime-water has a similar effect. Ammonia acts in the same way, but more feebly. If powder of morphia be suspended in water and treated with solution of sesquichloride of iron, a deep purplish-blue liquid is obtained, the blue tint of which is most predominant when the morphia is purest. This is the best test for morphia, and one which will suffice to distinguish it from all other bodies. It has been often analyzed, and with variable results. The most recent analysis, that of Regnault, represents the anhydrous alkaloid to consist of 72.41 per cent of carbon,

15.74 oxygen, 6.84 hydrogen, and 5.01 azote; which proportions approach nearly to the following constitution in chemical equivalents—$C^{35}H^{20}O^{6}N$ = 296.35.

Adulterations.—The chief adulterations of morphia are with narcotin and the colouring or resinoid matter of opium. It ought to be of the purest snowy whiteness when in powder. Narcotin is best detected by the action of solution of potash; which, while it readily dissolves morphia, leaves narcotin unattacked. Pure narcotin is best distinguished from morphia by the solution of sesquichloride of iron not forming with it a blue liquid. Most of the tests given in the formula of the London College are intended to serve as characters for recognizing it, and not as criterions of its purity.

Actions and Uses.—The actions of morphia are the same with those of its salts, as described under the head of its muriate; but it acts more feebly and irregularly on account of its insolubility. As it is scarcely ever used in medical practice, it seems an unnecessary addition to the Materia Medica.

Its dose however is from a fourth of a grain to twice or thrice as much.

MORPHIAE ACETAS, *E. L.* *Acetate of Morphia.*

Tests, *Edin.* One hundred measures of a solution of ten grains in half a fluidounce of water and five minims of acetic acid, heated near to 212° and decomposed by a faint excess of ammonia, yield by agitation a precipitate which in 24 hours occupies 15.5 measures of the liquid.

Tests, *Lond.* Very easily soluble in water: in other respects it presents the characters of morphia.

Process, *Edin.* Take of muriate of morphia any convenient quantity. Dissolve it in fourteen times its weight of warm water; and when the solution is cool, add Aqua ammoniæ gradually and with constant agitation, until there is a permanent but faint odour of ammonia in the fluid. Collect the precipitate on a calico filter, wash it moderately with cold water, and dissolve it by means of a slight excess of pyroligneous acid in twelve parts of warm water for every part of muriate of morphia that was used. Concentrate the solution over the vapour-bath and set it aside to crystallize. Drain and squeeze the crystals, and dry them with a gentle heat. More acetate of morphia may be obtained on concentrating the mother-liquor.

Process, *Lond.* Take of
Morphia, six drachms;
Acetic acid, three fluidrachms;
Distilled water, four fluidounces;
Mix the acid and water, add the morphia to saturation, and evaporate with a gentle heat to obtain crystals.

For. Names.—*Fren.* Acetate de morphine.—*Ital.* Acetato di morfina.—*Ger.* Essigsaures morphium.—*Russ.* Uksusnokisloe morphin.

The Acetate of Morphia was introduced into medical practice by Magendie soon after the discovery of its alkaloid.

Chemical History.—No process is yet known for obtaining it from opium directly like the muriate of morphia. The easiest and most economical way of obtaining morphia will therefore constitute the basis of the best process for preparing its acetate. This has been stated above to be the decomposition of its muriate by am-

monia; which method has been adopted by both the British Colleges. In combining the alkaloid with acetic acid it is convenient to leave a slight excess of the latter, as the salt crystallizes more readily. There is no profit in using an impure morphia, as some think, and then purifying the salt; because the muriate is more easily purified than the acetate. The method of the Pharmacopœias, skilfully applied, is the process followed by the manufacturers of this city; whose acetate of morphia is unrivalled in purity and whiteness. Merck states, that pure white crystals, entirely soluble in water, may be obtained by diffusing pure and finely-powdered morphia in distilled water, adding acetic acid very gradually, with constant stirring, till the powder is dissolved, and evaporating the solution quickly at a temperature not exceeding 112° F., by means of a current of air.

Acetate of morphia is in the form of a snowy white, obscurely crystalline powder, without odour, but of an intense, peculiar, bitter taste. It is decomposed and entirely dissipated by a strong heat. Water dissolves it readily, though not entirely,—because, when obtained by evaporating its solution, it generally parts with some of its acid, so that there is no longer enough to keep the whole morphia dissolved. Hence, in using this salt in solution, a few drops of acetic acid should be added to the water. It is soluble in rectified spirit. It does not crystallize well from any of its solutions. A moderately concentrated aqueous solution is rendered yellow by nitric acid and blue by sesquichloride of iron; and alkalis or alkaline earths precipitate morphia from it, but redissolve the precipitate if added in excess. Diluted sulphuric acid disengages acetic fumes from the salt, and imparts an acetous odour to the solution. This character, together with the effect of sesquichloride of iron, will serve to distinguish acetate of morphia from all other salts. It is probably composed of one equivalent of base, of acid, and of water ($C^{35}H^{20}O^{6}N+\bar{A}+Aq.$), that is, 296.35 parts of morphia, 51.48 acetic acid, and 9 water.

Adulterations.—Its only common adulteration is with colouring matter, owing to careless or unskilful preparation; and against this impurity the snow white colour of its powder is a sufficient check. It might be adulterated in many other ways with various white powders. But the Edinburgh formula will provide against most of these. The test consists in dissolving the salt with the aid of a few drops of acetic acid in a fixed proportion of water, and decomposing a certain measure of the solution by ammonia; and the bulk of the precipitate after twenty-four hours' rest proves whether or not the salt was free of impurity. I have found very uniform results in applying this method to a perfectly pure salt.

Actions and Uses.—The actions, uses, and doses of acetate of morphia are identical in kind with those of its muriate,—under which the reader will find them described. Such being the case, the present preparation should be abandoned in medical practice;

because it is with difficulty obtained as a perfect salt when crystallized, and because the muriate is more easily prepared. Some imagine that the acetate is less liable than the muriate to occasion disagreeable symptoms after, or instead of, its usual hypnotic effect; but it has always appeared to me, that this is a mistake, and that it signifies little, towards the action of the base, what the combined acid may be.

The usual dose of acetate of morphia as a hypnotic and anodyne, is from a quarter of a grain to half a grain.

MORPHIAE MURIAS, *E.* MORPHIAE HYDROCHLORAS, *L.* *Muriate of Morphia.*

TESTS, *Edin.* Snow-white: entirely soluble: solution colourless: loss of weight at 212° not above 13 per cent: one hundred measures of a solution of 10 grains in half a fluidounce of water, heated near to 212°, and decomposed with agitation by a faint excess of ammonia, yield a precipitate which in twenty-four hours occupies 12.5 measures of the liquid.

TESTS, *Lond.* Soluble in water. The precipitate thrown down in this solution by nitrate of silver is not entirely soluble in hydrochloric or nitric acid, or in ammonia unless added in excess.

PROCESS, *Edin.* Take of
Opium, twenty ounces;
Water, eight pints;
Muriate of lime, an ounce or a slight excess.

Macerate the opium in fragments for twenty-four hours in two pints of the water; and separate the infusion, squeezing well the residue. Repeat the maceration successively with two pints more of the water till the whole is made use of. Concentrate the whole infusions over the vapour-bath. Decant the clear liquid, and add the muriate of lime dissolved in four fluidounces of water. Set the whole aside to settle; pour off the liquid; wash the sediment with a little water, adding the washings to the liquid. Evaporate the liquid sufficiently in the vapour-bath for it to solidify on cooling. Subject the cooled mass to very strong pressure in a cloth; redissolve the cake in a sufficiency of warm distilled water; add a little fine powder of marble, and filter; acidulate the filtered fluid with a very little muriatic acid; and concentrate a second time in the vapour-bath for crystallization. Subject the crystals again to very strong pressure in a cloth. Repeat the process of solution, clarification by marble and muriatic acid, concentration and crystallization, until a snow-white mass be obtained.

On the small scale trouble and loss are saved by decolorizing the solution of muriate of morphia by means of a little purified animal charcoal after two crystallizations. But on the large scale it is better to purify the salt by repeated crystallization alone, and to treat all the expressed fluids, except the first, in the same way with the original solution of impure muriate of morphia. An additional quantity of salt may often be got from the first dark and resinous fluid obtained by expression, on merely allowing it to remain at rest for a few months, when a little muriate of morphia may be deposited in an impure condition.

The opium which yields the largest precipitate by carbonate of soda according to the formula for testing Opium, will yield muriate of morphia not only in greatest proportion, but likewise with the fewest crystallizations.

PROCESS, *Lond.* Take of
Opium, sliced, a pound;
Crystals of chloride of lead, two ounces or a sufficiency.
Purified animal charcoal, 3½ ounces;
Hydrochloric acid, — Distilled water, — and Solution of ammonia, of each a sufficiency.

Macerate the opium for 30 hours in four pints of distilled water, bruise it, digest for twenty hours more, and express the liquid. Repeat this process a second and third time with more water and the residuum, until the latter become tasteless. Concentrate the united liquids to a syrup with a heat of 140°; add three pints of distilled water; and when the dregs have subsided, pour off the clear liquor. To this add gradually two ounces of chloride of lead dissolved in four pints of boiling distilled water, or as much as will cause complete precipitation. Pour off the liquor, wash the precipitate, and

concentrate the united liquors as before, so that crystals may form with rest and cooling. Squeeze these in a cloth; dissolve them in a pint of distilled water; digest the solution at 120° F., with an ounce of pure animal charcoal; filter, and having washed the charcoal, concentrate the united liquors cautiously to obtain pure crystals.—Dilute the mother-liquor of the first crystallization with a pint of water, and add gradually, with occasional agitation, a sufficiency of solution of ammonia to throw down the whole morphia. This being washed with distilled water, saturate it with hydrochloric acid; digest with two ounces of animal charcoal; filter, and wash the charcoal, and concentrate the liquors cautiously to obtain pure crystals.

MORPHIAE MURIATIS SOLUTIO, E.

PROCESS, *Edin.* Take of
Muriate of morphia, one drachm and a-half;
Rectified spirit, five fluidounces;
Distilled water, fifteen fluidounces.
Mix the spirit and the water; and dissolve the muriate of morphia in the mixture with the aid of a gentle heat.

TROCHISCI MORPHIAE, E.

PROCESS, *Edin.* Take of
Muriate of morphia, a scruple;
Tincture of tolu, half an ounce;
Pure sugar, twenty-five ounces.
Dissolve the muriate of morphia in a little hot water; mix it and the tincture of tolu with the sugar; and with a sufficiency of mucilage form a proper mass for making lozenges; each of which should weigh about fifteen grains.

TROCHISCI MORPHIAE ET IPECACUANHAE, E.

PROCESS, *Edin.* Take of
Muriate of morphia, a scruple;
Ipecacuan, in fine powder, a drachm;
Tincture of tolu, half a fluidounce;
Pure sugar, twenty-five ovnces.
Proceed as for *Troch. Morphiæ.*

FOR. NAMES.—*Fren.* Hydrochlorate de morphine.—*Ital* Idroclorato di morfina.—*Ger.* Salzsaures morphium.—*Russ.* Solekisloi morphin.

MURIATE OF MORPHIA was little employed in medicine till Dr William Gregory in 1831 improved a process proposed originally by Wittstock, for obtaining it directly from opium without the use of spirit. Since that time it has come into general use in Britain; and in Edinburgh it has displaced every other preparation of morphia, and also materially the common preparations of opium.

Chemical History.—The essential part of Dr Gregory's process is the decomposition of the natural salt in opium, the meconate of morphia, by means of another salt, which, by double affinity, detaches a meconate of its own base as an insoluble precipitate, and leaves its acid united with the morphia in the form of an easily crystallizable salt. And the only other material step is the purification of this salt by repeatedly dissolving and recrystallizing it, and then decolorizing it with animal charcoal.—Dr Gregory employed muriate of lime for the decomposing salt. Dr A. T. Thomson proposes to substitute the muriate of baryta; and the London College has adopted the muriate of lead. Frequent experience however satisfies me, that neither these, nor any other changes proposed, except in the mere mode of manipulating, effect any improvement on the original process of Gregory. And this opinion coincides with the practice of the Edinburgh manufacturers, who continue to follow that process, and who produce a salt of unrivalled purity and cheapness.——It is important to exhaust the opium with little water, so as to avoid protracted heat in concentrating the infusions. Exhaustion may be accomplished, so far as the morphia

is concerned, with considerably less water than the Pharmacopœias direct. With due care four times the weight of the opium will be found sufficient. The whole morphia is removed long before the residuum loses its taste,—a fact of which the London College seems not to have been aware.—Both Colleges are wrong in directing the muriate of lime or lead to be added after, instead of before, concentrating the infusions; for in the latter way a larger and purer product is obtained with less repeated crystallizations.—The evaporation of the liquid, after removal of the meconate of lime or lead, should be conducted at a heat rather below 212°, but as quickly as possible; because under long-continued or strong heat the muriate of morphia becomes more difficult to free of colouring resinoid matter.—The concentrated liquids should be left all night to crystallize, before the operator proceeds to subject the mass to the press. If, as sometimes happens, crystallization should not have taken place, it is instantly produced by stirring the solution.—The suggestion of the Edinburgh College to dispense with animal charcoal in operating on the great scale, and rather to purify the salt by multiplying the crystallizations, is a doubtful improvement. The trouble of repeatedly concentrating the solutions and expressing the crystallized salt, will more than compensate the trifling loss sustained by the absorbing power of the charcoal.—When the muriate is tolerably white, the rest of the colouring matter may be often removed, as the Edinburgh Pharmacopœia directs, by alternately acidulating its solution with muriatic acid, and neutralizing it with marble, together with intermediate filtration. Three crystallizations are sufficient to produce a snow-white muriate of morphia from fine opium; but different opiums vary much in this respect.—By attending to the precautions now stated, care being also taken to save the mother-liquors, and to let the first of them stand for some months before working it, the manufacturer will obtain from good Turkey-opium so much as twelve or even thirteen per cent of the finest muriate. This is the proportion now obtained by those who manufacture it in Edinburgh upon the large scale. The best opium for the purpose is the recent soft Smyrna opium, which is light-brown in colour, and thickly covered with the seeds of a species of rumex, but not with large leaves (see *Opium*).

Muriate of morphia is commonly sold in the form of a pure white powder. It is without odour, but has an intensely bitter taste, different from that of opium, and peculiar to the morphia salts generally. It is permanent in the air. A gentle heat fuses it; a stronger heat decomposes and disperses it. It is entirely soluble in its own weight of water at 212°, and in fourteen parts at 60°; so that a concentrated boiling solution forms almost a firm crystalline cake on cooling. When carefully crystallized it forms beautiful radiated masses of delicate sattiny needles. It is also readily soluble in rectified-spirit. Diluted sulphuric acid decomposes it, disengaging its muriatic acid. Strong nitric acid forms

with it a deep-yellow fluid, and acts similarly on its solution unless much diluted. Spirit of nitric ether slowly communicates to its solutions a yellow colour. The alkalis and lime-water precipitate morphia from the solution, but redissolve it when added in excess,—especially potash and lime. Nitrate of silver throws down chloride of silver from the solution. Sesquichloride of iron forms a fine purplish-blue liquid with the salt, and also with its solution if it contain not much less than one per cent; and the tint is the finer, the purer the salt. The constitution of the muriate of morphia is supposed to be one equivalent of the base, one of its acid, and six of water ($C^{35}H^{20}O^{6}N + HCl + 6Aq$), or 76.24, 9.66, and 14.1 per cent. In the pure salt dried at 150° I have constantly found only 12.7 per cent of water.

The pharmaceutic preparations of muriate of morphia are the *Solutio muriatis morphiæ*, the *Trochisci morphiæ*, and the *Trochisci morphiæ et ipecacuanhæ* of the Edinburgh Pharmacopœia. The first of these contains a little rectified-spirit, to prevent decomposition, which is otherwise apt to occur when the solution is long kept. In strength it is intended to be equivalent to laudanum.

Adulterations.—The only impurities met with at present in the muriate of morphia of commerce are colouring matter and moisture,—both of them owing to insufficient care in purifying and drying it. But many other adulterations are practicable. The London formula for testing it seems intended only to discover its acid; which is thrown down by nitrate of silver in the form of chloride of silver. The Edinburgh formula provides against undue moisture or discoloration. And the volume of the precipitate deposited in a given time, after agitating a solution of fixed strength with ammonia, will furnish an approximation to the morphia contained in different specimens: At least, in applying this test to various specimens of pure muriate of morphia, I have obtained uniform results.——It is said that narcotin, which, next to morphia, is the most abundant crystalline principle of opium, sometimes occurs as an adulteration. I have never met with it in the salt of commerce; but it is easily detected by the precipitate, occasioned in a solution by caustic potash, being only in part soluble in an excess of the reagent.——Muriate of morphia obtained by double decomposition always contains a little codeïa, another of the crystalline principles of opium. The proportion varies, according to my experiments, between a 60th in muriate from fine Turkey opium, a 30th in that from the inferior sorts, and so much as a 12th in what is obtained from some East-Indian opiums. Its presence in such small proportion does not affect the action of the salt. It does not exist in the salt prepared by combining muriatic acid directly with morphia, which has been precipitated by ammonia; for it remains dissolved as a double salt.

Actions and Uses.—The muriate of morphia is a narcotic, anodyne, hypnotic, calmative, sedative, stimulant, and diaphoretic;—

in short, it possesses essentially all the actions of opium. The reader is referred to the article Opium for a full statement of these actions. In the present place it will be sufficient to mention in what particulars the two substances coincide or differ in their effects.

•Muriate of morphia is a powerful narcotic poison, and produces as such the same symptoms which are produced by opium. Ten grains have proved fatal to man, and undoubtedly less would suffice. It is at least equal to opium as an anodyne in subduing pain, and as a sedative in allaying local irritation. As a hypnotic it is considered by some to be not less effectual; but it has appeared to me to produce more frequently than opium that state of calm reverie, which the latter also sometimes excites instead of sleep, and which seems scarcely less serviceable than sleep in restoring from fatigue, or removing nervous excitement. It produces energetically the same union of calmative and stimulant effects on the nervous system which opium usually produces in the habitual opium-eater. In action on the circulation it is identical with opium; its activity as a diaphoretic is the same; and it has the same tendency to constipate the bowels. The uneasy headache, giddiness, brown tongue, sickness, loss of appetite, indigestion and undefinable feeling of misery, which in many persons succeed towards morning the operation of a sleeping dose of opium, are far more seldom caused by muriate of morphia; and still more rarely do we meet in its instance with the excitement, watching, alarm, frightful dreams, and febrile state of the circulation, which certain individuals experience from the action of the crude drug, instead of its customary soporific effect. Another consideration of some moment is, that in consequence of its taste being different from that of opium, it may be given without the patient necessarily knowing that he is taking a preparation of that drug. Farther, it possesses these important advantages in a greater degree than any of the secret or patent nostrums, with opium for their base, which were previously and deservedly in general use, such as the acetic solution, Battley's sedative liqüor, or the black drop.

It must be acknowledged, that muriate of morphia does occasionally produce the disagreeable subsequent and idiosyncratic effects so often caused by the galenical preparations of opium. But cases of the kind are rare. Some have ascribed them to the commercial salt containing a little of the alkaloid codeïa, which is known to be an excitant of the nervous system. But this view is inconsistent with the small proportion of codeïa that exists in any ordinary medicinal dose of the muriate, and with the large dose of codeïa, about five grains, which is required to produce decided excitement.——When muriate of morphia is long used, its doses must be increased in the same manner as those of the common preparations of opium.

There is scarcely any special purpose served by opium, for which this salt may not be advantageously substituted, except in the cases

of rare occurrence where it is necessary to compel deep sleep, and the constitution of the individual is known to agree with opium itself. It may be united with calomel, with tartar emetic, with ipecacuan, with acetate of lead, or with vegetable astringents, to accomplish the various objects which are attained by combining opium with these substances. In the form of lozenge, with or without ipecacuan, it is the best of all sedatives for allaying cough, from whatever cause, provided there be no general fever present at the same time.

The doses of its preparations are: *Morphiæ murias*, E. *Morphiæ hydrochloras*, L. gr. ¼ ad gr. ss.—*Solutio muriatis morphiæ*, E. min. xx. ad min. xl.—*Trochisci morphiæ*, E. x. ad xx. daily.—*Trochisci morphiæ et ipecacuanhæ*, E. x. ad xx. daily.

MOSCHUS, *E. L. D. Inspissated secretion (Liquid, L.) from the præputial follicles of Moschus moschiferus, (Edin. Lond.) The concretion, called Musk, (Dub.)*

MISTURA MOSCHI, L.

PROCESS, *Lond.* Take of
Musk,
Gum-arabic, bruised, and
Sugar, of each three drachms;
Rose-water, a pint.
Beat the musk with the sugar, and then with the gum, adding the rose-water gradually.

TINCTURA MOSCHI, D.

PROCESS, *Dub.* Take of
Musk-powder, two drachms;
Rectified-spirit, one old wine pint.
Macerate for seven days, and strain.

FOR. NAMES.—*Fren.* Musc.—*Ital.* Muschio.—*Span.* Almizcle.—*Port.* Almiscar.—*Ger.* Bisam.—*Dut.* Muskus.—*Swed.* Desman; Mysk.—*Dan.* Desmer.—*Russ.* Kabarga.—*Arab.* and *Pers.* Mishk.—*Tam.* Castoori.

THE date of the introduction of MUSK into medicine is uncertain; but it has been used in Europe for many centuries.

Natural History.—It is produced by the *Moschus moschiferus* of Linnæus, which inhabits Thibet and other parts of central Asia, but more especially the Himalaya and Altaï mountains. It is a wild ruminating animal, rather larger than the domestic goat, and approaching the deer in its characters. At the posterior part of its abdomen there is a small sac situated immediately under the skin, which opens a little in front of the præputial orifice for the penis, and which is filled with a thick fluid, abounding particularly in the rutting season. This fluid in the dried state is musk. It is removed from the animal in its containing bag, and dried in this state for exportation to Europe and elsewhere.

The musk-bag, or musk-pod, as it is absurdly called in trade, is usually plano-convex; and in general the plain surface is a bare membrane, while the convex surface is covered with stiff hairs; but sometimes the hairy and membranous parts are reversed. It weighs, along with its contents, between five and nearly ten drachms, and contains on an average two drachms and two-thirds of musk (Pereira). Musk is in the form of irregular, reddish-

black, rather unctuous grains, and possesses an overpowering, most penetrating, diffusive odour, and a bitterish, corresponding taste. Rectified-spirit is the best solvent of its odoriferous part. Its composition has been examined by Guibourt and Blondeau in France, and by Geiger and Reinmann in Germany; from whose researches it appears to consist of stearin, elaïn, cholesterin, a peculiar fixed acid, resin, osmazome, numerous salts, and free ammonia, along with an odoriferous principle which adheres to the ammonia, and has not yet been separately detached.

Adulterations.—Spurious musk-bags are often met with in commerce. These are commonly larger and plumper than the true ones, sometimes entirely covered with hair, sometimes partly covered by a flat membrane stitched to the hairy part, and always without the aperture in the middle of the hairy portion, which may be seen in every true musk-bag. The hairs of the true musk-bag appear before the microscope to consist of numerous distinct trapezoidal cells (Neligan), but this is not distinctive, as a similar appearance has been observed in the hairs of spurious musk-bags (Pharm. Journ. Vol. v.) There are besides two qualities of musk-bags, one of which is usually rejected as inferior in quality. These are Thibet or Chinese musk, and Siberian or Cabardine musk, the latter of which is very inferior to the other as a perfume.

Actions.—Musk was long considered a powerful stimulant, tonic and antispasmodic, and was administered as a remedy of last resort in typhoid fever and other diseases of nervous exhaustion—to such patients as could afford it. But it is now scarcely ever prescribed. It has been recently ascertained to be somewhat hypnotic in small doses, and in large doses it causes headache, tremors, and even convulsions (Jörg). It accelerates somewhat the pulse, increases the perspiration, and imparts to the secretions its peculiar odour.—From five to twenty grains are necessary to produce any effect. It should therefore be given in powder or emulsion. The Dublin tincture is more likely to act through its spirit than its musk.

MUCUNA, *E. L.* DOLICHOS PRURIENS, *D.* *The hairs from the pods of Mucuna pruriens*, DC. *Cowitch.*

For. Names.—*Fren.* Pois à gratter.—*Ital.* Dolico pizzicaulo.—*Ger.* Juckende fasel; Kuhkratze.—*Tam.* Poonaykalie.—*Hind.* Kiwach.

Figures of Mucuna pruriens, in Bot. Reg. for 1838, 18.—Steph. and Ch. iii. 179.

This plant seems not to have been attended to by medical botanists prior to Ray, who says the pods were used in the form of decoction in the West-Indies for the cure of dropsy. Dr Bancroft and Mr Kerr about the year 1780 were the first to introduce into the Materia Medica the present officinal article, the hairs of the pods.

Natural History.—The plant was long considered a species of *Dolichos;* from which genus it has been detached with some others

under the generic name of *Stizolobium*, Willd., &c. or *Mucuna*, DC. The latter of these terms is now most generally adopted. The officinal species is *Mucuna pruriens*. It is a twining shrub belonging to the Linnæan class and order *Diadelphia Decandria*, and to the Natural family *Leguminosæ*. It abounds in woods and fences in the West-Indian islands, and often climbs to the tops of the highest trees. It bears clusters of pods about four inches long and scarce half an inch broad, which are thickly beset with strong, brown bristles, finely pointed, and serrated towards the extremity. These bristles constitute the officinal substance Cowitch or Cowhage, a term which is probably a corruption of the West-Indian aboriginal name Cadjuet. The bristles adhere obstinately to the skin, where they excite intense heat and itching. They contain some tannin, but apparently no acrid principle (Martius); so that their effect is probably mechanical. They are usually imported into this country attached to their pods; from which they are afterwards scraped off either simply, or with the aid of syrup, to prevent them fastening on the operator's hands.

Adulterations.—Cowitch is not subject to adulteration. Occasionally however the bristled pods are mixed with those which have been scraped. Other species belonging to the same genus have the same structure of pod and the like properties, and may therefore supply a similar officinal article. Among these may be mentioned the *Mucuna urens* from the neighbourhood of Vera Cruz in Mexico, and the *M. prurita* of the East-Indies, which was first distinguished from the West-Indian species by Sir W. Hooker.

The only purpose to which Cowitch is applied is to the treatment of intestinal worms, for which it is an efficacious remedy. It is administered with syrup, which, when thickened with the hairs to the consistence of honey, may be given to the extent of a tea-spoonful or upwards to a table-spoonful, without causing any inconvenience to the patient. A purgative is usually given a few hours afterwards. It is chiefly serviceable in lumbricus and ascarides, and has little effect in tape-worm. The animals are discharged alive; a circumstance, which, together with some observations made on worms out of the body by Mr Chamberlayne, would seem to shew, that it acts merely by fixing upon them, and causing them the same kind of torture which is occasioned when it adheres to the human skin. Correa, a Portuguese author, has lately maintained, that it is the best of all vermifuge remedies for lumbricus. He gave every morning before breakfast, for three days, a tea-spoonful of a mixture composed of half an ounce of syrup and two scruples of cowitch, and a draught of castor-oil after the last dose. —Oil is the best application for allaying the heat and itchiness it excites when applied to the skin.

MYRISTICA, *E. L.* NUX MOSCHATA, *D.* *Kernel of the fruit of Myristica officinalis, Linn. Suppl.* (*Edin*).—*of Myristica mschata, Willd.* (*Lond. Dubl*).—*Nutmeg.*

MYRISTICAE ADEPS, *E.* *Concrete expressed oil from the kernel of the fruit of Myristica, &c.—Oil of Mace.*

MYRISTICAE OLEUM. *Volatile oil from the kernel of the fruit of Myristica, &c.—Oil of Nutmeg.*

MACIS, *D.* *Involucrum* (*arillus*) *of the nut of Myristica, &c.—Mace.*

SPIRITUS MYRISTICAE, E. L.—SPIRITUS NUCIS MOSCHATAE, D.

PROCESS, *Edin. Lond. Dub.* Take of Nutmeg bruised, two ounces and a-half (two ounces, D.); Proof-spirit, one (old wine, D.) gallon; Water, a pint (enough to prevent empyreuma, D.) Mix them (macerate for twenty-four hours, D.), and distill off one (old wine, D.) gallon.

FOR. NAMES.—*Fren.* Muscades.—*Ital.* Noce moscada.—*Span.* Nuez muscada.—*Port.* Noz moschada —*Ger.* Muskatnusse.— *Dut.* Muskaatnoten.—*Swed.* Muskott.—*Dan.* Muskatnöd.—*Russ.* Mushkatnoi orechi.—*Arab.* Jowzalteib.—*Pers.* Jowz bewa.—*Tam.* Jadicai.—*Hind.* Jaiphal.

FIGURES of Myristica officinalis in Bot. Mag. 2756 and 2757.—As M. moschata in Hayne, ix. 12.—Steph. and Ch. ii. 104.—As M. aromatica in Roxb. cor. pl. iii. 267.—Nees von E. 133.

THE NUTMEG was known to the Arabian physicians, but seems to have attracted little attention in Europe till after the discovery of the passage to India round the Cape of Good Hope. The ancient Greeks and Romans were probably unacquainted with it.

Natural and Chemical History.—It is produced by a plant belonging to the Linnæan class and order *Diœcia Monadelphia,* and to the Natural family *Myristicaceæ.* This is the *Myristica officinalis* of the younger Linnæus, the *M. moschata* of Thunberg, and Willdenow, or *M. aromatica* of Roxburgh and Nees von Esenbeck. It is a tree towards thirty feet in height, which inhabits moist and shady places on the Molucca Isles, especially on the Island of Banda; whence it has been successfully transplanted to Sumatra, the Mauritius, French Guiana, and various West Indian islands.

The officinal parts are the kernel of the fruit and the arillus of the nut. The fruit is a drupa, about the size and somewhat of the appearance of a small peach. It has a pulpy exterior or pericarp, which splits into two parts when ripe, and displays a fleshy, reticulated, scarlet or crimson arillus, covering a thin, hard, brittle, deep-brown, glassy shell; and within the shell is contained an oval kernel about the size of a pigeon's egg, which consists chiefly of a bulky albumen. The kernel is the Nutmeg of the grocer and druggist; the arillus is the Mace of commerce; and the fleshy pericarp is sometimes brought to this country as a preserve.

The NUTMEG is imported chiefly from the Moluccas. A single tree yields on an average six pounds; but some yield so much as twenty pounds. It is imported without its shell,—a practice which renders it more liable to decay or injury from insects, and which originated in the precautions taken long ago by the Dutch to prevent

the tree from being propagated elsewhere than in their Spice Islands. The finest sorts are small, short, nearly round, heavy,—externally marked with reticulated furrows, and white from having been dipped for preservation in milk of lime,—internally grayish-red and beautifully marbled with darker brownish-red veins, from which oil may be easily expressed with the point of a warm knife. A less esteemed sort is larger, longer, lighter, less marbled, and not so oleaginous. The former are sometimes called female, and the latter male nutmegs. Both have a strong, peculiar, grateful odour, and a powerful, bitter, aromatic taste. The powder is grayish-brown, and somewhat fatty. If beaten to a pulp with a little water and pressed between heated plates, it yields from ten to thirty per cent of a fragrant, orange-coloured, concrete oil, the *Adeps Myristicæ* of the Edinburgh Pharmacopœia, commonly but incorrectly called Oil of Mace. The best quality of this oil is prepared at the Moluccas, and is imported into Europe in rectangular cakes, enveloped in the leaves of some monocotyledonous plant. An inferior sort is expressed in Holland from spoiled nutmegs. It has the consistence of suet, and possesses the odour and taste of the nutmeg. It is soluble in four parts of boiling rectified-spirit, which in cooling deposits the solid part of the oil (Myristine) in silky crystals. Myristine is a compound of myristic acid ($C^{28}H^{17}O^{3}$) and glycerine (Playfair). The crude fat likewise contains a liquid fixed oil, and about 16 per cent of volatile oil. The nutmeg itself consists according to Bonastre of 54 per cent of lignin, 24 stearin, 7.6 elaïn, 6.0 volatile oil, 2.4 starch, 1 gum, and 0.8 of an acid substance. This analysis does not agree with that of Schrader, who obtained considerably less volatile oil, and much more gummy extractive. But great differences must exist in the composition of the kernel according to its quality. The volatile oil, the *Oleum Myristicæ* of the Pharmacopœias, is obtained by distilling powder of nutmegs with water. It is colourless or pale yellow, and possesses the aroma and bitterness of the kernel. It is of the density 920 to 948, and is soluble in rectified-spirit and in ether. When long kept, it deposits a crystalline stearoptin, which some have considered a peculiar principle under the name of Myristicin.

Adulterations.—Nutmegs are often injured, and therefore of low quality. Those which are light, worm-eaten, or marbled with black lines ought to be rejected. Those produced elsewhere than on the Molucca Islands are considered of inferior quality, and indeed are scarcely commercial. I have received however fine nutmegs both from St Vincent and from Grenada. The kernels of *Myristica tomentosa*, also a native of the Molucca Isles, are said to be sometimes substituted for true nutmegs; but they are easily distinguished, as they are twice as long, and much more feebly aromatic. The Oil of Mace is often imitated with a spurious article, which is probably compounded in various ways, and which I have found on one occasion to be composed of spermaceti, flavoured with volatile

oil of nutmeg and coloured with saffron. These sophisticated articles are known by being not entirely soluble in four parts of boiling rectified-spirit.

MACE has been needlessly adopted as an officinal article by the Dublin College. When fresh, it has a fine crimson hue. But when dried, it is dingy yellow, thin, membranous, and somewhat flexible. It has the odour and taste of nutmeg. Though more esteemed in cookery, it really possesses no advantage over the cheaper kernel. It seems to contain nearly the same principles, and among the rest a similar concrete fatty matter, and a volatile oil not essentially different.

Actions and Uses.—Nutmeg possesses the general properties of the aromatic stimulants, of which it is one of the most agreeable and most in use. It is principally employed as a condiment for seasoning various articles of food and drink, and in medicine as an adjunct for correcting the nauseating effect of other drugs on the stomach. In large doses it is said to possess narcotic qualities.

The doses of its preparations are:—*Oleum Myristicæ*, min. v. ad min. x. *Spiritus Myristicæ*, fl.dr. ii. to fl.unc. ss.

MYRRHA, *E. L. D.* *Gummy resinous exudation of Balsamodendron (Protium?) Myrrha, Nees von Esenbeck, Plant. Medic. (Edin. Lond.). Source unknown (Dubl.). Myrrh.*

TINCTURA MYRRHAE, E. L. D.

PROCESS, *Edin.* Take of
Myrrh, in moderately fine powder, three ounces and a half;
Rectified-spirit, two pints.
Pack the myrrh very gently without pressure in a percolator: then pour on the spirit; and when two pints have passed through, agitate well to dissolve the oleo-resinous matter which first passes, and which lies at the bottom. This tincture is much less conveniently prepared by the process of digestion for seven days.

PROCESS, *Lond. Dub.* Take of
Myrrh bruised, three ounces;
Rectified-spirit, two pints (half an old wine pint, and Proof-Spirit, a pint and a half, D.)
Digest for fourteen (seven, D.) days and strain.

PILULAE ALOES ET MYRRHAE. See *Aloes*.

TINCTURA ALOES ET MYRRHAE. See *Aloes*.

FOR. NAMES.—*Fren.* Myrrhe.—*Ital.* and *Span.* Mirra.—*Port.* Myrrha.—*Ger.* Myrrhe.—*Dut.* Mirre.—*Swed.* Myrra.—*Dan.* Myrrha.—*Russ.* Mirra.—*Arab.* Murr.—*Tam.* Valatipolum.—*Hind.* Bowl.

Balsamodendron Myrrha figured in Nees von E. 357.

MYRRH has been known from a remote era, having been one of the articles used by the Israelites for frankincense. The Greeks gave the name of Σμυρνα to a gum in the form of tears from Arabia, the description of which by Dioscorides corresponds sufficiently with the modern myrrh.

Natural History.—The tree which produces it, though often sought for, was unknown to modern botanists till between 1820 and 1825, when it was seen by the botanical traveller Ehrenberg near Gison, on the confines of Arabia Felix. It belongs to the

Linnæan class and order *Octandria Monogynia,* and to a subdivision of Decandolle's Natural family *Terebinthaceæ,* which has been erected into a distinct order by Lindley under the title of *Burseraceæ.* From an examination of Ehrenberg's specimens Nees von Esenbeck was led to arrange it in Kunth's genus *Balsamodendron,* —a genus comprising, among other species, the *Amyris Kataf* of Forskal, which was previously conceived to be the probable source of myrrh. The *Balsamodendron Myrrha* is a shrub which grows under the shelter of woods composed of acacias and other tall trees. Its trunk and branches consist of a yellowish-white wood and very pale gray bark, neither of which has any odour. The branches are spiny; the leaves are ternate, with the terminal leaflet four or five times as large as the two lateral ones; and the fruit is oval and much drawn out towards the extremity. This description differs essentially from that of *B. Kataf,* with which some botanists, and among these Dr Lindley in his Flora Medica, have considered it identical. For in the latter "the branches have no thorns; the leaves are four times as large; the leaflets are nearly uniform in size; and the fruit is round, and impressed and umbilicate at its end" (Nees von E.) Ehrenberg, who saw myrrh formed upon the plant near Gison, says that the juice flows out about the consistence of oil, but soon becomes butyraceous and gradually concrete, passing at the same time from yellowish-white to golden-yellow, and at length to brownish-red. The myrrh-tree has since been seen in profusion by the expedition of Captain Harris growing in hilly localities throughout the flat territory between Abyssinia and the Red Sea.

Myrrh is imported into this country in large chests, chiefly from the shores of the Red Sea, by way of Bombay. It varies much in quality. The best kind, which should alone be used in medicine, and which is called First or Turkey myrrh, consists of irregular pieces, often tuberculated, varying in size from that of a pea to that of a large walnut, and occasionally attaining that of the fist. The large pieces are dull externally, the small ones more shining, and both of them of a reddish-brown colour, which becomes clearer red when they are breathed upon. Internally they are brighter reddish-brown than on the surface, but varied with yellowish-white, opaque, semicircular or tortuous streaks. When the finer pieces of this kind of myrrh are selected from the chests as they are imported, it is called Picked Turkey Myrrh in the drug-trade. The inferior qualities will be noticed under the head of the adulterations.

Chemical History.—Myrrh is brittle and pulverizable. It has a peculiar, agreeable, balsamic odour, and a bitter aromatic, not unpleasant taste. When heated, it softens but does not melt, then froths up, and at length takes fire and burns with difficulty. It consists of 2.6 per cent of volatile oil, 27.8 of resin, and 63.7 of gum [44.7 resin and 40.8 gum, according to Righini], together

with small portions of various malates, acetates, phosphates, and sulphates, besides impurities. The volatile oil, which is at first colourless, gradually becomes yellow, and under exposure to the air passes to the state of an unctuous varnish. It passes over in distillation with water; but not with alcohol. The resin consists of two kinds, one of which is soft, bitter, acrid, and soluble in ether, while the other and more abundant of the two is harder, tasteless, and insoluble in ether. The gum consists of 9.3 parts of bassorin or insoluble gum and 54.4 of a variety of arabin or soluble gum, which makes with water a stronger mucilage than gum-arabic. ——When myrrh is treated with water, its arabin is dissolved, and the mucilage retains the oil and part of the resin in the state of emulsion. Proof-spirit dissolves some of the resin and less of the gum. Rectified-spirit readily dissolves the whole resin and oil, leaving the greater part of the gum. The last fluid is the best officinal menstruum for myrrh, because the oil and resin are its active constituents; and it has accordingly been adopted by the London and Edinburgh Colleges for making the *Tinctura Myrrhæ.* This tincture is best made by percolation. Most of the active principles pass through at the beginning with a little alcohol, forming a thick, viscid, oleo-resinous fluid; and when the whole spirit directed by the Pharmacopœia has been transmitted, gum alone is left. The oleo-resin, which first passes through, is insoluble in the proof-spirit once directed by the Edinburgh College for this tincture; but the due proportion of rectified spirit at once dissolves it with the aid of agitation.——The tincture is the only officinal form acknowledged by the Colleges in which myrrh exists in the simple state; but it forms part of many compound preparations, such as the *Pilula aloes et myrrhæ,* E. L. D.—*Pilula ferri composita,* L. D.—*Pilula galbani composita,* L. D.—*Pilula assafœtidæ composita,* E.—*Pilula rhei composita,* E.—*Tinctura aloes et myrrhæ,* E.—*Decoctum aloes* (*compositum,* D.) E.—and *Mistura ferri composita,* L. D.

Adulterations.—Myrrh is often adulterated. A considerable part of it is imported in a mixed state, constituting what is called Myrrh in Sorts, and is picked or sorted in Europe. It then contains many pieces of true but inferior myrrh, which are darker externally than the superior qualities, or sometimes deep brown,—more opaque,—internally whiter, or on the contrary dark brown,—full of mechanical impurities,—and of a weaker and less pure odour and taste than good myrrh. It also contains many pieces of the gum-resin called Bdellium; and indeed even boxes of fine myrrh are seldom without some lumps of this substance. It is easily known by its more resinous appearance and want of unctuosity, its greater hardness, the absence of the true odour on a fresh surface, and its own peculiar, less balsamic, and somewhat terebinthine taste. Tears of different kinds of gum are also met with as adulterations. These are easily known by the transparency of a fresh fracture,

and the total absence of the proper odour.——Dr Pereira describes two inferior kinds of myrrh not unfrequently met with in commerce, which he calls Second Myrrh, and Third or East-Indian Myrrh. The former is in small tears seldom bigger than a pepper-corn, varying in colour from pale-yellow to reddish-brown, and composed of true myrrh intermixed with gum-arabic and a sort of resin. The latter,—whose name though once appropriate, is now inexact, when all qualities may alike come by way of the East-Indies,—seems to consist of the coarser pieces of Turkey myrrh with many impurities.

Actions and Uses.—Myrrh is a heating stimulant. It promotes digestion, accelerates the pulse, and raises the animal temperature. Large doses might cause inflammation. It is a mild diaphoretic. It is not, like the fetid gum-resins, an antispasmodic. On account of its stimulant action on the stomach, it is used in torpid states both of that organ and of the intestines. It has been highly esteemed as an emmenagogue in disturbed menstruation and chlorosis, but in that respect is not now in much repute. It is supposed to partake, with copaiva and other oleo-resinous substances, in the property of arresting chronic gonorrhœa, chronic catarrh, and other excessive mucous discharges. It is one of the drugs which have in succession had their day as approved remedies for pulmonary consumption; and it formed part of two celebrated nostrums for that disease, called Griffith's Pill and Griffith's Mixture, for which the *Pilula* and *Mistura ferri composita* are substitutes. It is now less used internally, than externally for local objects. It is a good application to indolent sores, gangrenous ulcers, and aphthous or sloughy sore-throat; and both the powder and tincture are approved dentifrices for cleansing the teeth and consolidating the gums.

The doses of its preparations are: *Myrrha*, gr. x. ad gr. xxx.—*Tinctura myrrhæ*, fl.dr. i. ad fl.dr. ii.

MYRTUS PIMENTA, *D.* See *Pimenta.*

NICOTIANA TABACUM, *D.* See *Tabacum.*

NUX-VOMICA, *E. L. D.* *Seeds of Strychnos Nux-vomica, L. W. Spr. Nux-vomica.*

Extractum Nucis Vomicae, E. D.

Process, *Edin.* Take of Nux-vomica any convenient quantity; expose it in a proper vessel to steam until it is completely softened; slice it, dry it thoroughly, and grind it in a coffee-mill; exhaust the powder either by percolating it with rectified spirit, or by boiling it with repeated portions of rectified spirit, till the spirit comes off free of bitterness. Distil off the greater part of the spirit; and evaporate what remains to a proper consistence in the vapour-bath.

Process, *Dub.* Take of
Nux-vomica rasped, eight ounces;
Proof-spirit, two pints.
Digest for three days in a close vessel; filter the liquor, and express the residue. Digest the residuum for three days in a

pint and a half of proof-spirit; filter and express again. Distil the tinctures to a fourth, and concentrate to the due consistence.

TINCTURA NUCIS-VOMICAE, D.

PROCESS, *Dub.* Take of
Nux-vomica rasped, two ounces;
Rectified-spirit, eight ounces.
Macerate for seven days, and strain.

STRYCHNIA. See *Strychnia.*

FOR. NAMES.—*Fren.* Noix-vomique.—*Ital.* Noce-vomica.—*Span.* Nuez vomica; Mataperros.—*Port.* Noz vomica.—*Ger.* Krähenauge; Brechnuss.—*Dut.* Braaknooten.—*Swed.* Räfkaka.—*Dan.* Krandsöine.—*Russ.* Tschilibucha; Kutscheliaba.—*Arab.* Khanck-ulkelb.—*Tam.* Yettie Cottay.—*Hind.* Koochila.

FIGURES of Strychnos Nux-vomica in Hayne, i. 19.—Nees von E. 209.—Roxb. Cor. Pl. i. 24.—Steph. and Ch. ii. 52. Roque, 81.

NUX-VOMICA is not mentioned by any Greek or Roman author, but was known to the Arabian physicians. It has been used immemorially in medicine by the natives of Hindostan. In modern European medicine it was little known till very lately, although it has long been a familiar substance as a bitter narcotic for the adulteration of beer.

Natural History.—The *Strychnos Nux-vomica,* which produces it, is a species of the Natural family *Strychneae* of Decandolle, which Lindley includes with the *Apocynaceae.* It belongs to the Linnæan class and order *Pentandria Monogynia.* It inhabits the Indian continent and islands, and abounds particularly on the Malabar and Coromandel coasts. It is a considerable tree, with a short crooked stem,—a grayish, shining bark, covered for the most part with gray tubercles, or with an ochrey efflorescence,—a white tough wood,—oval, shining, leathery leaves,—and small greenish-white clustered flowers. The fruit, which is of the size and appearance of an orange, is a berry composed of a leathery, dingy-orange-red tegument, and a juicy mucilaginous pulp, in which are imbedded from two to five seeds. The seeds, the officinal part of the plant, are circular and flat, towards an inch in diameter and two lines in thickness, umbilicated at one surface, every where thickly beset with short, brown, sattiny hairs, and internally translucent, exceedingly tough and almost horny. Every part of the plant except the pulp of the fruit is intensely bitter, but especially the seeds and the bark.

Chemical History.—Nux-vomica seeds are with difficulty reduced to a state of fine division. The simplest method is that of the Edinburgh Pharmacopœia, which directs them to be softened well with steam, and then sliced, dried, and ground. The powder has a grayish-yellow colour, a faint sweet odour, and an intense, durable, bitter taste. Water, proof-spirit, and rectified-spirit dissolve the bitter active ingredients; and the last solvent acts most energetically. Ether removes chiefly a concrete oil and some wax. Nitric acid renders the powder orange-red. The watery decoction is pale grayish-yellow and intensely bitter. It is turned orange-yellow by nitric acid, and emerald-green by sesquichloride of iron.

When concentrated, it yields with alkalis a grayish-white precipitate, which is most intensely bitter and presents alkaline properties, —being in fact a mixture of two alkaloidal principles. As spirit acts more powerfully than water on powder of nux-vomica, it is preferred by the Pharmacopœias for making the officinal *Extractum* and *Tinctura nucis vomicae*. The directions of the Edinburgh College for making the extract are the most precise. When well prepared, it may be known from all other extracts by its most intense, pure, durable bitter taste, and by nitric acid turning its watery solution yellow. Nux-vomica, according to the analysis of Pelletier and Caventou, consists of concrete oil, wax, yellow colouring matter, soluble gum, starch, lignin, a peculiar acid named igasuric acid, and two peculiar alkaloids, to which the seed owes its action on the animal body, and which constitute little more than four parts by weight in one thousand. Of these alkaloids, which are called Strychnia and Brucia, the former is by much the more energetic. Their properties will be found particularly noticed under the article Strychnia.

Adulterations.—Nux-vomica in powder is much subject to adulteration, chiefly because foreign substances are mixed with it to facilitate pulverization. Common salt, which is said to be a frequent admixture, is easily discovered by lixiviating the powder with cold water and obtaining the salt by evaporation and crystallization.

The seed is not the only product of the nux-vomica tree which is known in European medicine. Both the wood under the name of Snake-wood, or *Lignum colubrinum*, and the bark under the erroneous designation of False-Angustura Bark, have attracted some attention in the western part of the old world. Snake-wood, a remedy once in use as a febrifuge, anthelmintic, and antidote to snake-poison, is generally referred to a different species, the *Strychnos colubrina*, but is often nothing else than nux-vomica wood. The bark deserves more particular notice. It is well known that soon after the beginning of the present century fatal accidents repeatedly occurred on the continent in consequence of druggists having mistaken for Angustura-bark, a poisonous bark, which was supposed to be that of an Abyssinian tree, the *Brucea ferruginea*. This bark having been analyzed by Pelletier and Caventou about the same time with nux-vomica seeds, they found in the former an alkaloid which was identical with one of those discovered in the latter, and which they termed brucin or brucia. But the reference of this poisonous bark to the Abyssinian plant was a mistake. Some years ago I ascertained that French specimens in my possession under the name of False-Angustura bark were identical in their characters with specimens of nux-vomica bark sent to me from Calcutta by Dr Jackson; and about the same time Dr O'Shaughnessey of Calcutta found both strychnia and brucia in nux-vomica bark,—a result which I have since confirmed. Nux-vomica bark presents two distinct appearances,—some pieces being on their outer surface

grayish-green or grayish-yellow, mottled with numerous paler-gray tubercles,—others, and these the larger pieces, being pretty uniformly covered with a friable rusty-coloured efflorescence. Both varieties are intensely bitter. The rusty efflorescence is turned deep greenish-black with nitric acid; and the same reagent applied to a transverse section of either variety strikes a dark-orange colour. Infusion of galls causes a grayish-white precipitate in its decoction. These characters, when compared with those mentioned under the article *Cusparia*, will be found to be quite different from what are presented by true Angustura-bark.—From some trials it appears to me probable that nux-vomica bark might be advantageously substituted for the seeds in the preparation of strychnia.

Actions and Uses.—The actions of nux-vomica will be stated more particularly under the head of its active principle strychnia, with which it exactly coincides, and which is now commonly employed instead of it. It is a powerful narcotic, of that limited class which act almost entirely on the spinal column, producing in poisonous doses violent tetanic convulsions without impairing the functions of the brain. Two drachms of the powder have proved fatal in two hours, and even fifteen grains have caused death (Traill). Those who recover from the primary effects on the nervous system may suffer from irritation in the alimentary canal; and an instance is on record of death being thus apparently produced in three days by three grains of the spirituous extract. Nux-vomica is chiefly used on account of its stimulant action on the nervous system in cases of chronic palsy, both general and partial. It is now almost confined to this disease; but in earlier modern physic it was esteemed by many as a febrifuge in intermittents, as an astringent in dysentery, and as a specific sedative in gout and rheumatism.—There seems no particular reason why the powder and extract should have been displaced by the principle strychnia. For their effects are precisely the same; and the principle is not only troublesome to prepare, but likewise, being seldom pure, is liable to the objection of irregular strength, which is brought against the galenical preparations of the drug. On account of the taste of these preparations, they ought to be given in the shape of pill; and for the like reason the Dublin tincture is an inconvenient form.

The doses of the preparations of nux-vomica are: *Nucis-vomicæ pulvis*, gr. v. ad gr. xv.—*Extractum nucis-vomicæ*, E. D. gr. ss. ad gr. iii. *Tinctura nucis-vomicæ*, D. min. xxx. ad fl.dr. i.

OLEA. See *Olivæ Oleum.*

OLEUM AETHEREUM, *D.* See *Aether sulphuricus.*

OLIBANUM, *L. D. Gum-resin of Boswellia serrata, Colebrooke, Asiat. Research. Olibanum.*

FOR. NAMES.—*Fren.* Oliban.—*Ital.* Olibano.—*Span.* Incienso fino.—*Ger.* Weihrauch.—*Swed.* Wirach; Virak.—*Russ.* Ladon.—*Arab.* Looban.—*Tam.* Paringhi sambrani.—*Hind.* Koondir zuchir.

Boswellia serrata figured in Nees von E. 355.—Hayne, x. 46.—St. and Ch. iii. 147.

MR COLEBROOKE was the first to prove, that the *Boswellia serrata* yields the modern gum-resin called Olibanum, sometimes imported under the name of Frankincense from the East; and that this was the frankincense of the ancients, and Λιβανος of Dioscorides. The plant is a fine forest-tree, a native of the Coromandel coast and other parts of India. It belongs to the Linnæan class and order *Decandria Monogynia*, and is one of the *Terebinthaceæ* in Decandolle's Natural arrangement, or the *Burseraceæ* in that of Lindley. It is the *Boswellia thurifera* of some botanists, the *B. serrata* of Colebrooke. Olibanum is a gummy-resinous exudation from the trunk or branches. It consists of brittle pale-yellowish tears, roundish or oblong, powdery on the outside, translucent within, of a resinous balsamic odour, and of an acrid bitterish taste. These are composed of 56 per cent of resin, 30 gum, 5.2 glutinoid matter, and 8 volatile oil of a yellowish colour and citron odour (Braconnot).

Like other resinous substances containing volatile oil, olibanum is a stimulant, and might be substituted both inwardly and outwardly for other stimulant gum-resins. But it is scarcely put to any medicinal use in these respects, and is now employed only in the form of pastilles for fumigations. It is one of the best materials for that purpose; to which it has been applied immemorially by the Israelites and Hindoos.

OLIVAE OLEUM, *E. L. D.* *Expressed oil of the pericarp of Olea Europæa L. W. Spr.* *Olive-oil.*

TESTS, *Edin.* When carefully mixed with a twelfth of its volume of solution of nitrate of mercury prepared as for the Unguentum citrinum, it becomes in three or four hours like a firm fat, without any separation of liquid oil.

UNGUENTUM SIMPLEX, E.

PROCESS, *Edin.* Take of
Olive-oil, five fluidounces and a half;
White wax, two ounces;

Melt the wax in the oil, and stir the mixture briskly while it concretes in cooling.

FOR. NAMES.—*Fren.* Huile d'olive.—*Ital.* Olio d'oliva; Olio.—*Span.* Aceyte comun.—*Port.* Oleo comum; Azeite.—*Ger.* Baumöl.—*Swed.* Bomolja.—*Dan.* Bomolie.—*Dut.* Olijfolie.—*Russ.* Olivkovoe maslo.——*The fruit, Arab.* Zietoon.—*Hind.* Julpaïy.

FIGURES of Olea Europæa in Nees von E. 212.—Hayne, x. 10.—Steph. and Ch. i. 15.

THE OLIVE-TREE has been known from a very remote period. It was one of the articles of produce in the Land of Promise, and was familiar to the Israelites. It is likewise mentioned by Homer under its Dioscoridean name Ελαιη.

Natural History.—It now grows naturally on most parts of the Mediterranean coasts, but is supposed to have come originally from Asia Minor; and tradition refers its introduction into France to the Phœnicians about 700 years before Christ. It is extensively cultivated in many parts of the south of Europe, but especially in Spain, Italy, Sicily, and southern France. It is the *Olea Europæa* of botanists, a species of the Linnæan class and order *Diandria Monogynia*, and of the Natural family *Oleïneæ* or *Oleaceæ*. It is a small evergreen tree, presenting numberless varieties, of which two have been well defined since at least the days of Dioscorides,—the wild and cultivated, the Ελαια ἀγρια and ἡμερα. The former is a shrub or low tree with thorny branches and round twigs, the latter a taller tree, between twenty and thirty feet in height, with tetragonal twigs, and spineless. The fruit is a drupa, which when ripe is about the size and colour of the damson, and consists of a fleshy, greenish-white, oleaginous pericarp, a thick strong shell, and a small kernel or seed. The bark of the olive-tree was formerly used in medicine. Another product also sometimes employed is a morbid exudation, incorrectly called Olive-gum or Lecca-gum, which consists of a resin, a peculiar neutral crystalline principle called Olivilin, and some benzoic acid. The entire fruit gathered when not quite ripe, steeped for some time in lime-water or alkaline ley, and then pickled in brine, constitutes the olive of the grocer, an article in general use in some parts of Europe for the dessert. The only product of the plant now officinal is the oil produced by the fleshy pericarp of the fruit.

In the south of France the finest or virgin oil, which is rarely met with in commerce, is obtained by gathering the olives when they are quite ripe, crushing them without delay in a mill, and allowing the oil to flow out spontaneously. The ordinary oil of commerce, which is less valuable, but of good quality, is then got by covering the olives with hot water and expressing; an oil of lower quality (*huile d'enfer*) separates spontaneously from the water used in extracting the ordinary oil; and lastly, an impure oil (fermented oil) always musty tasted, is got by expression from olives which have been allowed to ferment (Gobley). Other varieties are introduced into the process in other countries. The finest oil comes from Provence and Florence, sometimes too from Genoa and Lucca; the commoner sort, imported into this country under the name of Gallipoli oil, is brought from Naples; and that from Sicily or Spain, which is generally fermented oil, is the worst of all (Pereira).

Chemical History.—Fine olive oil has a pale-greenish yellow tint, and keeps long without becoming rancid. The commoner sorts are deeper in colour and more subject to rancidity. When fresh, it is without odour and of a faintly sweet oleaginous taste; but like the fixed oils generally, yet more slowly than any other, it acquires a rancid flavour. Its density is 911 at 77° F. At the

temperature of 38° a considerable part of it solidifies in white crystalline grains. It slowly absorbs a large quantity of oxygen when exposed to atmospheric air or to oxygen itself, and it becomes in consequence thick, but does not dry up like linseed-oil. It is completely soluble in twice its volume of ether, but is only in part dissolved by alcohol unless in large proportion. It consists of two oleaginous principles, margarin and elain, in the proportion of 28 of the former and 72 of the latter (Braconnot). Margarin, its concrete principle, may be obtained by squeezing in bibulous paper the crystals which separate from the oil at a temperature about 20°; and the part which remains liquid at this temperature is nearly pure elain, its fluid principle. Few vegetable oils contain so large a proportion of margarin. When heated with alkaline solutions, olive-oil undergoes saponification (see *Sapo*); the sweet principle glycerin is detached, and soluble salts are formed in which the alkali is combined with several fatty acids. Hyponitrous acid, either free or in some states of combination, as in a solution of mercury in nitric acid made with the aid of heat, has the effect of rendering olive-oil concrete and firm, in consequence of its conversion into a new oleaginous principle called Elaïdin. This property is taken advantage of for determining the freedom of the oil from adulteration. Elaïdin is concretê at temperatures below 97°. It is converted by saponification into glycerin and a peculiar fatty acid, the elaïdic acid.

Adulterations.—Olive-oil is much subject to be adulterated with poppy-seed oil, rape-seed oil, and other cheap oils. Such mixtures require a lower temperature than pure olive-oil for the separation of margarin; they froth more when shaken. And the density of the oil is so much increased, that the adulteration may be detected and its amount estimated by taking its specific gravity accurately (Gobley). But the best method of detecting these impurities is the test derived by the Edinburgh College from the inquiries of Poutet. When pure olive-oil is mixed with a solution of mercury in nitric acid prepared with heat, the whole becomes in a few hours a firm fatty mass from the action of the hyponitrous acid in the solution. But if even so little as five per cent of any other oil be present, the consolidation is much less firm and more tardy; and if the proportion amount to twelve per cent, the foreign oil floats on the surface of a pulpy mass for several days before showing any tendency to concrete.

Actions and Uses.—Olive-oil is a nutrient, emollient, laxative, and anthelmintic. It is digestible when taken in small proportion to the solid food; but a large proportion disorders the stomach and bowels. An ounce or two may excite purging, but it is uncertain and often ineffective in its operation. In the dose of an ounce and upwards it is a good addition to clysters, either for general purposes, or for destroying ascarides in the great intestines. It may be of use as an emollient in irritant poisoning; but it is

not an antidote, as some have thought, either for arsenic or cantharides. Its most important application is as an external emollient, or for imparting due consistence to many ointments, liniments, and plasters. The Pharmacopœias contain numerous preparations of this nature, of which olive-oil forms a part.

OPIUM, *E. L. D.* *Concrete juice from the unripe capsules of Papaver somniferum, L. W. DC. Spr.* *Opium.*

TESTS, *Edin.* A solution from 100 grains of fine opium macerated 24 hours in two fluidounces of water, filtered and strongly squeezed in a cloth, if treated with a cold solution of half an ounce of carbonate of soda in two waters, yields a precipitate which weighs when dry at least ten grains, and dissolves entirely in solution of oxalic acid.

ELECTUARIUM OPII, E. CONFECTIO OPII, L. D.

PROCESS, *Edin.* Take of
Aromatic powder, six ounces ;
Senega, in find powder, three ounces ;
Opium, diffused in a little sherry, half an ounce ;
Syrup of ginger, a pound,
Mix them together, and beat them into an electuary.
PROCESS, *Lond. Dub.* Take of
Powder of hard opium, six drachms ;
Long-pepper, an ounce ;
Ginger, two ounces ;
Caraway, three ounces ;
Tragacanth-powder, two drachms ;
Syrup, sixteen fluidounces.
Pulverise the solids very finely, and preserve them in a covered vessel. When the confection is to be used, add the syrup heated, and mix them (*Lond.*)
Triturate the opium with the syrup heated ; add the other articles previously pulverised ; and mix them (*Dub.*)

EMPLASTRUM OPII, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Powder of opium, half an ounce ;
Burgundy-pitch (Frankincense in powder, L.) three ounces ;
Litharge-plaster, a pound ;
(Water, eight fluidounces, L.)
Melt the plaster, add the pitch and opium by degrees, and mix them thoroughly (*Edin. Dub.*)
Add the pitch, opium and water to the melted plaster ; and boil with a gentle heat to the proper consistence (*Lond.*)

ENEMA OPII, E. L. D.

PROCESS, *Edin.* Take of
Starch, half a drachm ;
Tincture of opium, half a fluidrachm to one fluidrachm ;
Water, two fluidounces.
Boil the starch in the water, and when it is cool enough for use, add the tincture of opium.
PROCESS, *Lond.* Take of
Decoction of starch, four fluidounces
Tincture of opium, thirty minims.
Mix them.
PROCESS, *Dub.* Take of
Tincture of opium, a drachm ;
Tepid water, six ounces ;
Mix them.

EXTRACTUM OPII, E. EXT. OP. PURIFICATUM, L. EXT. OP. AQUOSUM, D.

PROCESS, *Edin.* Take of
Opium, a pound ;
Water, five pints.
Cut the opium into small fragments, macerate it for twenty-four hours in a pint of water, break down the fragments with the hand, express the liquid with pretty strong pressure ; break down the residuum again in another pint of the water, let it macerate for twenty-four hours, and express the liquid ; repeat the maceration and expression in the same way till the water is all used. Filter the successive infusions as they are made, passing them through the same filter ; unite and evaporate them in the vapour-bath to the due consistence.
PROCESS, *Lond.* Take of
Opium, sliced, twenty ounces ;
Distilled water, a gallon.
Add a little water to the opium, and macerate for twelve hours to soften it. Then adding gradually the rest of the water, triturate to mix them well, and set the whole aside for the impurities to subside. Filter, and evaporate to the due consistence.
PROCESS, *Dub.* Take of
Opium, sliced, two ounces ;
Boiling water, a pint.

Triturate the opium with the water for ten minutes, and in a little time pour off the liquor. Triturate the opium which remains with as much boiling water for the same time; and pour off the liquor. Do this a third time. Mix the liquors, and expose them in an open vessel to the air for two days. Strain through linen, and concentrate to an extract with a low heat.

Linimentum Opii, E. L. Linimentum Saponis cum Opio, D.

Process, *Lond. Dub.* Take of
Soap-liniment, 6 (4, D.) fluidounces;
Tincture of opium, two (three, D.) fluidounces.
Mix them.

Process, *Edin.* Take of
Castile-soap, six ounces;
Opium, an ounce and a-half;
Camphor, three ounces;
Oil of Rosemary, six fluidrachms;
Rectified-spirit, two pints.

Pilulae Opii, *sive* Thebaicae, E.

Process, *Edin.* Take of
Opium, one part;
Sulphate of potash, three parts;
Conserve of red roses, one part.
Beat them into a proper mass, and divide it into five-grain pills.
It is to be observed that this pill contains twice as much opium as the opiate pill of the last Latin edition of the Edinburgh Pharmacopœia.

Pil. Saponis Comp. L. Pil. Sap. cum Opio, D.

Process, *Lond. Dub.* Take of
Turkey opium (in powder, L.) half an ounce;
Hard soap, two ounces.
Beat them together into a uniform mass.

Pilulae Styracis, E. D. Pil. Styr. Compositae, L.

Process, *Edin.* Take of
Extract of storax, two parts;
Opium, and
Saffron, of each one part.
Beat them into a uniform mass, which is to be divided into four-grain pills.

Process, *Lond. Dub.* Take of
Storax (strained, L.) three drachms;
Turkey-opium (in powder, L.), and
Saffron, of each one drachm.
Beat them to a uniform mass.

Pulvis Cretae Opiatus, E. Pul. Cret. Comp. cum Opio, L. D.

Process, *Edin. Lond. Dub.* Take of
Compound chalk powder, six ounces (and a-half, L. D.);
Powder of opium, four scruples.
Triturate them thoroughly togethe

Trochisci Opii, E.

Process, *Edin.* Take of
Opium, two drachms;
Tincture of tolu, half an ounce;
Syrup, eight fluidounces;
Powder of gum-arabic, and
Extract of liquorice, softened with boiling water, of each five ounces.
Reduce the opium to a fluid extract by the formula for *Extractum opii*; mix it intimately with the liquorice, previously reduced to the consistence of treacle; add the tincture; sprinkle the gum and sugar into the mixture, and beat it into a proper mass, which is to be divided into lozenges of ten grains.

Acetum Opii, E. D.

Process, *Edin. Dub.* Take of
Opium, four ounces;
Distilled vinegar, sixteen fluidounces;
Cut the opium into small fragments, triturate it into a pulp with a little of the vinegar, add the rest of the vinegar, macerate in a closed vessel for seven days, and agitate occasionally. Then strain, express strongly, and filter the liquors.

Tinctura Opii, E. L. D.

Process, *Edin.* Take of
Opium, sliced, three ounces;
Rectified-spirit, a pint and seven fluidounces:
Water, thirteen fluidounces and a-half;
Digest the opium in the water at a temperature near 212° for two hours; break down the opium with the hand; strain and express the infusion; macerate the residuum in the spirit for about twenty hours, and then strain and express very strongly. Mix the watery and spirituous infusions and filter.
This tincture is not so easily obtained by

percolation; but when the opium is of fine quality, it may be prepared thus. Slice the opium finely; mix the spirit and water; let the opium macerate in fourteen fluidounces of the mixture for twelve hours, and then break it down thoroughly with the hand; pour the whole fluid and pulpy mass into a percolator; and let the fluid part pass through; add the rest of the spirit without packing the opium in the cylinder, and continue the process till two pints are obtained.

PROCESS, *Lond.* Take of
Powder of opium, three ounces;
Rectified-spirit, two pints;
Macerate fourteen days and strain.

PROCESS, *Dub.* Take of
Opium in coarse powder, ten drachms;
Proof-spirit, one old-wine pint;
Macerate for fourteen days, and then strain.

TINCTURA OPII CAMPHORATA, E. D.

TINCTURA CAMPHORAE COMPOSITA, L.

PROCESS, *Edin.* Take
Opium, sliced, and
Benzoic acid, four scruples of each;
Camphor, two scruples and a half;
Anise-oil, one fluidrachm;
Proof-spirit, two pints;
Digest for seven days, and then filter.

PROCESS, *Lond. Dub.* Take of
Opium powder, seventy-two grains (a drachm, D.);
Camphor, two scruples and a half (two scruples, D.);
Benzoic acid, seventy-two grains (a drachm, D.);
Anise-oil, a fluidrachm;
Proof-spirit, two (old wine, D.) pints;
Digest for fourteen days and then strain.

TINCTURA OPII AMMONIATA, E.

PROCESS, *Edin.* Take
Benzoic acid, and
Saffron chopped, of each three drachms;
Opium sliced, two drachms;
Anise-oil, half a drachm;
Spirit of ammonia, a pint;
Digest seven days and filter.

VINUM OPII.

PROCESS, *Lond.* Take of
Extract of opium, two ounces and a half:
Cinnamon, bruised, and
Cloves, bruised, of each two drachms and a half;
Sherry, two pints;
Macerate fourteen days and strain.

PROCESS, *Edin. Dub.* Take of
Opium, three ounces (one ounce, D.);
Cinnamon, in moderately fine powder (bruised, D.), and
Cloves, bruised, of each two drachms and a half (one drachm, D.);
Sherry, two pints (one old wine-pint, D.);
Digest seven days and filter.

ELECTUARIUM CATECHU COMPOSITUM, E. D. See *Catechu.*

PILULAE OPII ET IPECACUANHAE, E. See *Ipecacuanha.*

PILULAE CALOMELANOS ET OPII, E. See *Hydrargyri chloridum.*

PULVIS IPECACUANHAE COMPOSITUS. See *Ipecacuanha.*

UNGUENTUM GALLAE ET OPII, E.

UNGUENTUM GALLAE COMPOSITUM, L. See *Galla.*

FOR. NAMES.—*Fren.* Opium.—*Ital.* Oppio.—*Span.* and *Port.* Opio.—*Ger.* Opium; Mohnsaft.—*Swed.* Opium.—*Dan.* Opium; Velmuesaft.—*Russ.* Opium.—*Arab.* Ufyoon.—*Pers.* Afeoon; Abeoon; Zire-auk.—*Tam.* Apini.—*Beng.* Aphim.—*Hind.* Uphim; Afyun.

FIGURES of Papaver somniferum in Nees von E. 405.—Hayne, vi. 40.—Steph. and Ch. iv. 159.

Papaver officinale in Nees von E. 404.

OPIUM was known to the ancient Greek physicians. At least among the various preparations of the Μηκων 'ημερος, which is supposed by many to have been the modern garden-poppy, there is

one, the μηκωνος 'οπος, or poppy-juice, which was prepared in ancient times, as we learn from Dioscorides, very nearly in the same way as opium is now made from the same plant in Asia Minor, Hindostan, and Europe. The Μηκωνειον of Dioscorides, probably the same with the Μηκωνιον of Hippocrates, although considered by some modern authorities to have been opium, is distinctly described by the former to have been prepared as an extract from the expressed juice of the poppy-capsules and leaves. Whether the Greeks discovered the drug, is a question which cannot now be settled. But they seem to have a better title to this merit than either the Persians or Hindoos, for whom it has been sometimes claimed; because in Hindostan the opium-poppy is not indigenous, and in the languages of both countries, the common names for opium, Afeoon, (Pers.) Afyun, Aphim, Uphim, *Beng.* and *Hind.* seem to have been derived from the Greek 'οπος, used, probably κατ' ἐξοχην, to denote the juice of the poppy. Opium was transmitted by the Greek physicians to their Arabian successors, by whom it was familiarly used. In tracing its progress from them through the dark ages downwards, its fame as a remedy, and the variety of its applications in medical practice, will be found to have gone on steadily increasing even to the present day.

Natural History.—The plant whence opium is obtained belongs to the Linnæan class and order *Polyandria Monogynia*, and the Natural family *Papaveraceæ.* A drug of the same generic characters may be got from several species of the family, among which may be mentioned *Papaver Rhœas*, *P. dubium*, *P. bracteatum*, and *P. somniferum.* But there seems now scarcely any doubt, that the commercial opium of every country is produced by varieties of our common Garden-poppy, the *Papaver somniferum.* An attempt has indeed been recently made, first by Gmelin and again by Nees von Esenbeck, to show that the true opium-poppy is not a mere variety of *P. somniferum*, but a distinct species. This plant, to which they give the name of *P. officinale*, is distinguished from the other by its greater stature, the deficiency of bluish bloom on its stem and leaves, the invariable whiteness of its flowers, the greater size of its capsules, the whiteness of its seeds, and especially by the circumstance that the capsules on ripening remain closed at the top, instead of presenting numerous apertures under the persistent stigma. It is however doubtful whether these characters are constant (Hayne), or even whether they constitute adequate specific distinctions (Lindley); and at any rate there is much ground for supposing that the white poppy does not yield the best kind of opium. The opium-poppy is indigenous in Western Asia, and probably too in the south of Europe. But in consequence of the facility with which it may be acclimatized, and the early period at which its cultivation was practised in various countries for the sake of making opium, its true native sources can scarcely now be determined. It grows with luxuriance, flowers vigorously, and ripens

its seeds with certainty, even in this climate. The flowers appear in slow succession in June and July; and the capsules ripen their seeds about two months after the flowers blow.

Opium is produced by the capsules only. When these are in the green state, and more especially near maturity, they abound in a thick white juice, which flows freely from superficial incisions, and concretes in the air into a pale-brown, tough, adhesive substance. This is opium. The details of its collection differ in different countries where it is made,—namely in Asia-Minor, Hindostan, Egypt, and Europe. But the essential steps of the process for obtaining fine opium is to make several horizontal or oblique incisions into the capsules, without penetrating into their cavity,—to collect the juice in twenty-four hours, or sooner in rainy, precarious climates, —to allow it to inspissate considerably in thin layers or perhaps in the original tears,—and then to let it harden in larger masses varying from a few ounces to several pounds. The finest opium of Asia-Minor probably consists of minute agglutinated tears; and some of it is certainly composed of thin layers, partially inspissated on poppy-leaves, and afterwards united along with the leaves into roundish masses. That of Egypt, Hindostan, and Europe is quite homogeneous; and the commonest of the Indian varieties undergoes a species of fermentation, and is made up for commerce before it is thoroughly inspissated. The opium of Asia-Minor is either wrapped in poppy-leaves, or covered with the winged seeds of a species of *Rumex;* that of Egypt is covered in the former way; the common soft Indian kind is made into large balls encased thickly with tobacco-leaves, and the petals of the poppy; and the finer sorts from the same country are either packed with coarse powder of the dried poppy-leaves and flowers, or in square cakes with interposed plates of mica. The amount of opium produced from a given quantity of land cultivated for the purpose varies much in different countries. It has been said that sixty pounds avoirdupois are produced in Hindostan upon an acre (Kerr); but later observers doubt the accuracy of this statement (Colebrooke). Experimentalists in Britain have obtained in limited operations a rate per acre varying from four pounds only (Jones) to fifty-seven pounds and a-half (Young). But the most satisfactory trial in this country was one made in 1823 in Buckinghamshire by Messrs Cowley and Staines on a scale of more than twelve acres, which yielded 196 pounds of very fine opium, or about sixteen pounds per acre. This was a remunerating produce at the time; but the great reduction that has since taken place in the price of Turkey opium would now render such an agricultural undertaking ruinous. There is much still to be learned however as to details in growing opium. In particular it is doubtful whether agriculturists in Hindostan, or experimentalists in Britain, have been right in choosing the white variety of the poppy for cultivation. Late trials in Germany tend to show, that of its three chief varieties, the white, red,

and purple poppy, the white yields least opium, and the purple most of all; and that opium from the last kind contains nearly three times as much morphia as the white, but only an eighth part of its narcotin, while the opium from the red poppy is intermediate between the two others in both respects (Biltz). I am also assured by Mr Fleming, formerly Opium-inspector at Calcutta, that in Behar, where much of the Indian opium is prepared, the white poppy is known to yield an article inferior both in quantity and quality to what is produced by the red and purple varieties; but that it is preferred, because thought to suit the climate best.

There are five principal kinds of opium more or less known to druggists,—namely, Turkey, Egyptian, East-Indian, European, and Persian opium. But the first two are the only kinds much used in this country.

TURKEY-OPIUM is at present the most prized in Europe. That which is imported to Europe is all prepared in Anatolia. For some years past it has been disposed of by the Turkish government to a few Smyrna merchants, and is delivered partly at that emporium, partly at Constantinople, but without any difference in quality according to the places of delivery (Stettner in Buchner's Repertorium). It is represented to be picked, and half a per cent is charged to the European merchant for that operation (Ibid). It is exported to Europe chiefly by English merchants, generally from Smyrna, but in part also from Constantinople. It comprehends several varieties; but there is some difficulty in attaching precise or permanent characters or names to them, probably because, when one variety comes into demand in the market, the inferior qualities are made up in imitation of it.——Druggists commonly speak of the finest variety of it under the name of CONSTANTINOPLE-OPIUM. This, I am informed, formerly implied what was picked at Smyrna for the Constantinople market; but it may be imported to this country direct, instead of going round by the Turkish capital, as seems to have been once the practice. This sort, which is now seldom met with, at least under its old name, is in roundish flat cakes, from four to eight ounces in weight, and usually covered only with a poppy-leaf. It is for the most part dry and hard, pale hair-brown in colour, and homogeneous in texture, or rather composed as it were of little agglutinated tears, like scales. Egyptian opium often resembles this kind in external characters, constitutes much of what is now occasionally sold as Constantinople-opium, and I suspect has been several times examined under that name by late chemical and pharmaceutic writers.——The name of SMYRNA-OPIUM is generally given to a variety from that port, which, from repeated analytic examination, as well as the concurrent opinion of various skilful druggists and manufacturing chemists, I am inclined to consider the best of the commercial varieties now currently met with. It is imported in lumps, which weigh from half a pound to three pounds, and which present various forms, owing to mutual

pressure in the soft state. They are thickly strewed on their exterior with rumex seeds, but seldom present any covering of the poppy-leaf. Their substance is rather pale brown, so soft as to be flexible, adhesive, and ductile, and so moist as to lose at least a sixth of their weight in the vapour-bath. When dry,—for their softness is owing simply to the character of this kind being so high as to cause its immediate sale on arriving in Britain,—the lumps seem to consist of minute agglutinated scales; and when cut they have a waxy lustre and retain their brown colour. This opium forms a pale infusion with water, is easily exhausted by maceration, produces a strong tincture, and is more productive in morphia than any other.——From the same port is brought the ordinary Turkey, or COMMON SMYRNA-OPIUM, sometimes inconveniently designated by the generic name Turkey-opium. It presents the forms and size of the last kind; it is commonly covered with poppy-leaves, and often too with rumex seeds; it is harder, because older; it has a darker, sometimes brownish-black colour internally; and it appears at times homogeneous, but sometimes composed of thin layers with interposed poppy-leaves. I have hitherto always found it less productive in morphia than the last variety; and such too is the experience of the Edinburgh manufacturers. Farther, it seems to be the kind which at present is chiefly made the subject of adulteration.

EGYPTIAN-OPIUM, comparatively a recent variety in English trade, is imported in round flat cakes, weighing from four to eight ounces, which are wrapped in a poppy-leaf, and have apparently been made up from the first in imitation of Constantinople opium. It is hard, dry, and brittle,—loses scarcely a fifteenth of its weight in the vapour-bath,—has a pale brown colour and waxy lustre,—and is quite homogeneous, being apparently without any foreign admixture except a few white-poppy seeds. It has been pretty largely imported into Britain, but its sale has decreased of late. It is for the most part of very inferior quality. But some of it must be excellent; for a specimen taken from a large quantity, which was purchased for Constantinople opium, yielded me rather more muriate of morphia than average opium from Smyrna.

EAST-INDIAN-OPIUM is made in greater quantity than any other kind. But, although some chests of it have been imported into Britain, it is scarcely an article of European commerce; nor will it ever become so, while such prices are given for it in the East, and until its quality be improved more nearly to the level of Turkey-opium. It is preferred to all other kinds in China for smoking, where its consumption is enormous, notwithstanding imperial edicts against its importation. It is chiefly made near Patna and Benares, and in the province of Malwah. Four kinds are distinguished in India, namely Benares, Patna or Behar, Garden-Patna, and Malwah-opium. Benares and Patna opium being identical in external characters, and very nearly in other respects, they are conveniently

designated by the common name of BENGAL-OPIUM. This, the most inferior of the East-Indian opiums, is made up in nearly round balls, weighing three pounds and a half, and not unlike in size and general appearance to a rusty 24-pound shot. These consist of a case about half an inch thick and half a pound in weight, formed of tobacco-leaves and agglutinated poppy-petals, and filled with a black, pitch-like mass, which is soft enough, even when some years old, to be taken out with a spatula. This sort having been not long ago much complained of as impure, and being not merely often adulterated, but likewise spoiled in consequence of the juice being kept long by the ryots or cultivators, so as to ferment before being made up,—an attempt was made to improve the preparation of it, during the inspectorship of Mr Fleming, by this gentleman and his assistant Captain Jeremie.—— The result is the kind called GARDEN PATNA-OPIUM. This variety, which has never been imported into Europe as an article of trade, is in cakes about four inches square and half an inch thick, weighing a quarter of a pound, and neatly packed with partitions of mica in cases of bees-wax, or in tin-cannisters or wooden boxes. By the time it reaches Britain it is hard, dry, and brittle, like Egyptian-opium, nearly of the same brown hue with that kind, and apparently much the same in texture. It is greatly superior to the common Bengal sort in balls; and I have examined specimens little inferior to average Turkey-opium in the quantity of morphia they contained.—— MALWAH-OPIUM, the third distinct variety, is in flat, roundish cakes, five or six inches in diameter, and weighing from four to eight ounces. They often present cracks near their circumference. They are commonly quite hard, dry, brittle, and almost pulverizable by the time they reach this country; they have a light-brown colour, a shining fracture, and a compact, homogeneous texture; and they are free of mechanical impurities. This sort is superior to common Bengal-opium, and probably, little, if at all, inferior to the Garden-Patna variety.—— The description now given of the Indian opiums is taken from a large supply of its several kinds, for which I am indebted to various friends in Bengal and Bombay, but especially to Dr Smyttan, Mr Fleming, and above all Dr Jackson, for some time Deputy Opium-inspector at Calcutta.

EUROPEAN-OPIUM, sometimes called indigenous, or in this country British, opium, has been made in Britain, France, Germany, and Greece. It has never become, and, for reasons formerly mentioned, probably never will become, commercial. That which was made by Dr Young of this city, the first decidedly successful cultivator of it, presents closely the characters of Egyptian or Malwah-opium, except that it is in roundish masses. It is hard, dry, pulverizable, light brown, shining, and perfectly homogeneous. Both that prepared by Dr Young, and what was afterwards made on a larger scale by Messrs Cowley and Staines, were much es-

teemed at the time by druggists, and fetched a better price in the market than fine Turkey-opium. And although late analyses, performed in London with specimens prepared since by others in England, have turned out rather unfavourably, the examination of that of Dr Young by Dr Gregory, and that of Cowley and Staines by Mr Hennell, justifies the estimation in which these opiums were held.

Persian-Opium is a kind which appeared a few years ago in British commerce, as an importation from Trebizond on the Black-Sea. It is made up in sticks about the thickness of the little finger, and five or six inches long, each of which is wrapped separately in paper. It is soft and flexible, and does not harden even when kept for years: it has a paler-brown colour than any other kind; and its texture is distinctly granular, as if it were composed of agglutinated tears. It seems of very low quality, and is so little esteemed in this country as scarcely to have ever taken possession of the market. In 1834 I saw in the London docks many large chests of it, which were quite unsaleable.

The different varieties of opium now described have certain common characters, with which their description may now be concluded. They have a strong, very peculiar odour, somewhat different in each, yet generically the same, and such as distinguishes them from every other substance. Their taste is most intensely and durably bitter, somewhat pungent, rather aromatic, and as peculiar as their odour. The odour and aroma are strongest perhaps in Bengal and Garden-Patna opium; but the fine Smyrna opium appears to me the most bitter of the whole varieties. Good opium does not undergo any change by keeping, except that it gradually becomes hard. The coarser Turkey kinds however, and the common Bengal sort in balls, sometimes become mouldy after a time; and the latter, in common with Persian-opium, seems never to harden thoroughly under exposure to the air, probably owing to the admixture of oil. They all soften under the application of a gentle heat; and at a higher temperature they burn, with the emission of peculiar odorous fumes. When dried in the vapour-bath, they lose from six to seventeen per cent of their weight, owing to the escape of moisture,—an irregularity in their constitution, which has led the London College to direct, that the galenical preparations of this drug shall be made with hard or dried opium. When thoroughly dried, they may be pulverised; but the powder is apt to cohere, unless kept carefully excluded from the air.

Chemical History.—The chemical relations of opium are interesting, but too complex to admit of being fully investigated here. Water, cold or warm, dissolves about two-thirds of Turkey-opium, including a great part of its active ingredients; a deep reddish-brown bitter infusion is formed; and the residuum consists chiefly of a substance analogous to caoutchouc, with a considerable proportion of one of its active, but least energetic, principles, called

narcotin. Rectified-spirit dissolves nearly four-fifths of its weight and the whole of its active parts. Sulphuric ether dissolves little else than narcotin, and on evaporation deposits it in fine crystals. The concentrated mineral acids disorganize opium; but the diluted acids, both mineral and vegetable, are powerful solvents, and exhaust it entirely of its active principles. The alkaline solutions in small quantity decompose it, and render its active parts insoluble, but dissolve them when used in excess. The watery infusions of opium are precipitated by the alkalis and alkaline earths, if not added in excess, by the salts of lime and magnesia, by the soluble salts of lead, copper, and many other metals, and by solutions of tannin, as well as all astringent vegetable substances. The infusion after the action of tannin or magnesia, and also after that of potash, lime, or ammonia, not used in excess, is found to have nearly or entirely lost its activity; but no such effect is caused by precipitation with salts, or with a large excess of potash, lime, or ammonia.

Opium is an extremely composite substance. The earliest decidedly successful analysis of it was made in 1812 by Sertuerner, a Hanoverian chemist, who was the first to separate its true active principle, and thereby make known the existence of the important class of vegetable alkaloids. From his researches, and the ulterior inquiries of Pelletier, Couerbe, Mulder, Biltz, Schindler, Merck, but above all Robiquet, it appears that in the first place, opium contains no fewer than seven crystalline principles, called Morphia, Codeia, Paramorphia, Narcotin, Narceïn, Porphyroxin, and Meconin, of which the first three are alkaline and the others neutral,—secondly, a peculiar acid termed Meconic acid, which constitutes, with sulphuric acid, the solvent of the active principles,—and thirdly, a variety of comparatively unimportant ingredients, such as gum, albumen, resin, fixed oil, a trace perhaps of volatile oil, lignin, caoutchouc, extractive matter, and numerous salts of inorganic bases.

The most important of its constituents, morphia, codeia, narcotin, and meconic acid, may be obtained by one series of operations in the following manner. A strong infusion is decomposed when cold by a slight excess of solution of muriate of lime, by which meconate of lime is thrown down, and muriates of morphia and codeia left in solution. The salts are obtained by concentrating the solution sufficiently to crystallize them, and then purifying the crystals as directed by the Edinburgh Pharmacopœia in its formula for preparing muriate of morphia (see *Morphiæ murias*). From the salt thus obtained morphia may be separated by decomposing the solution of the salt with ammonia, which does not throw down codeia. And the latter is got by concentrating the residual liquor sufficiently for crystallization, and adding solution of potash to the new salt to separate the codeia; which may be purified by dissolving it in boiling sulphuric ether, concentrating the solution to the consistence of a syrup, and then dissolving this in water, and crystallizing the alka-

loid. Narcotin is obtained from the opium exhausted in water, by macerating it with weak pyroligneous acid, decomposing the solution with potash, and purifying the precipitate by repeatedly crystallizing it from rectified-spirit. Meconic acid is got by acting on the meconate of lime with diluted muriatic acid at a temperature between 200° and 210°, but not higher,—collecting the crystals which form on cooling the solution, and acting again upon them with muriatic acid in like manner,—then repeating this step a third time, so as to produce a pale-gray meconic acid with a trace only of lime,—and lastly purifying the crystals thoroughly by neutralizing them with carbonate of potash, and decomposing the alkaline meconate in the same way as the original impure meconate of lime.—Merck has given the following formula for obtaining all the alkaloids and neutral crystalline bodies from one portion of opium. 1. Agitate powdered opium with boiling ether, which removes narcotin, meconin and caoutchouc; and from the etherial extract remove meconin by water, and then narcotin by alcohol. 2. Make the residuary opium into a pulp with water, decompose it with carbonate of potash, and agitate again with ether, which then contains codeia, paramorphia, porphyroxin, and caoutchouc; evaporate off the ether, dissolve the extract in weak muriatic acid, add ammonia to throw down paramorphia and porphyroxin together, and then potash to precipitate codeïa; redissolve the paramorphia and porphyroxin in ether, which by spontaneous evaporation deposits paramorphia in crystals and porphyroxin like a resin, the latter being then removable by the cautious use of alcohol. 3. Lastly, exhaust the residuary opium with rectified-spirit, obtain a spirituous extract, dissolve this in weak acetic acid, and add ammonia to precipitate morphia.

Morphia, the chief active principle of opium, was discovered by Sertuerner. It is distinguished by being crystallizable in sparkling, flat six-sided prisms, alkaline in its relations to acids and vegetable colours, soluble in alcohol, soluble without decomposition in solution of potash, insoluble in water or ether, capable of forming crystallizable salts with acids, convertible by nitric acid into an intense yellow fluid and by sesquichloride of iron into a fine blue solution, and possessed of an intensely bitter taste both in its free and combined conditions (see farther *Morphia*). Codeia, which was discovered by Robiquet, is characterized by being crystallizable in octaëdres, alkaline in respect to colours and acids, soluble in water, ether and alcohol, insoluble in solution of potash, and fusible in its own concentrated watery solution at a temperature of 212°. Narcotin, which was first seen by Derosne so early as 1803, but was not correctly distinguished from morphia till the investigations of Robiquet, is known by crystallizing from alcohol in thin unequally-bevelled, pearly tables, but in regular rhombic prisms from ether,—and by being neutral, insoluble in water, soluble in ether, boiling rectified-spirit, or diluted acids, insoluble in solution of po-

tash, convertible into a resinous-like substance by fusion, and incapable when pure of forming a yellow solution with nitric acid, or a blue one with sesquichloride of iron. Of the other crystalline principles, NARCEÏN, discovered by Pelletier, is known by its delicate silky needles, which are fusible below 212°, neutral, convertible into a light blue solution by diluted mineral acids, and capable of forming a bluish compound with iodine. PORPHYROXIN, discovered by Merck, is neutral, soluble in alcohol, ether, and weak acids, and convertible into a beautiful purple solution by strong acids aided by heat;—a property which has been thought delicate enough to supply a new medico-legal test of opium. MECONIN, first observed by Dublanc, has an acrid taste without bitterness, crystallizes in hexangular prisms, is neutral in respect to acids, fuses at 194°, and in this state forms with chlorine-gas a blood-red fluid, which crystallizes on cooling. PARAMORPHIA, frequently called also Thebaïna, and discovered by Thiboumery, crystallizes in grains from alcohol, and in very oblique rhombic prisms from ether, is acrid to the taste and alkaline in its chemical relations, fuses about 266°, does not dissolve in solution of potash, cannot form crystallizable salts with acids, and is not acted on like morphia by strong nitric acid or sesquichloride of iron. MECONIC ACID was first distinctly characterized by Robiquet. It is distinguished from other vegetable acids by its brilliant scaly crystalline form, by being changed to obscurely crystalline grains of metameconic acid if obtained from a solution that has been boiled, by yielding when strongly heated a crystalline sublimate of pyromeconic acid, and by producing when in solution a deep cherry-red fluid with the salts of sesquioxide of iron.—The atomic constitution of all these bodies, as deduced from the most recent and best analyses, is believed to be as follows: Morphia, $C^{35}H^{20}O^{6}N$, Codeia $C^{35}H^{20}O^{5}N$, Paramorphia $C^{25}H^{14}O^{3}N$, Narcotin $C^{46}H^{22}O^{13}N$, Narceïn $C^{28}H^{20}O^{12}N$, Meconin $C^{10}H^{5}O^{4}$, Meconic acid $C^{7}H^{2}O^{7}$ (Löwig).

The proportion in which the several crystalline principles of opium exist in the drug has been variously stated by different experimentalists, and seems to vary much in different kinds of opium. This is an important practical subject in relation to the widely different actions possessed by the several principles on the animal body, and the indiscriminate use often made of the several kinds of opium in practice. *Morphia* in some Turkey opiums forms scarcely four per cent; while it is said that the finer sorts from Smyrna yield eleven (Mulder) and even fifteen per cent (Merck). I have not been able to obtain by the new German processes, or in any other way, above nine per cent of perfectly pure morphia from the finest Smyrna opium. Egyptian opium yielded in Merck's hands six or seven, and one fine specimen I examined contained seven and a-half per cent; but Stöckhardt got only from three to four and a-half per cent. Payen obtained ten per cent from Algerian opium. European opium made in England yielded

to Mr Morson 4.4 and to Mr Hennell 7.5; but the researches of Biltz assign to that made in Germany from the purple poppy the proportion of 20 per cent; and Caventou speaks of obtaining no less than 28 per cent from a specimen of French growth, while his countryman Dublanc got only the fourteenth part of that amount. Of East-Indian opiums, Bengal investment opium for the Chinese market yielded two and a-half per cent (O'Shaughnessey). I have obtained from the Garden-Patna kind 6.5 of perfectly pure morphia; whilst Dr O'Shaughnessey has obtained as much as 10.5. The same chemist got 6 per cent from the Malwah variety; and Dr Smyttan got rather more than this; but the morphia he obtained was not quite colourless. Persian opium yielded to Merck only one per cent. These discrepant results cannot altogether arise either from differences in the constitution of the opium, or from the processes followed in analyzing it; but probably depend in part on the standard assumed by different experimentalists for what constitutes pure morphia. The extraordinary proportions assigned by some late German chemists are scarcely intelligible, if I may trust my own trials of their methods, except on the supposition of the morphia being estimated in an impure state. In my own experiments I took the proportion as contained in muriate of morphia after being rendered snow-white.—*Narcotin* seems often to observe an inverse proportion to the morphia. In Smyrna opium it varies from 1.3 to 8 per cent (Schindler, Mulder); in Egyptian opium Schindler found 2.7; in Garden-Patna opium I think it is abundant, but I have not determined its proportion; in German opium Biltz found it to vary from 6.25 in the purple-poppy variety to so much as 33 in that from the white-poppy, while in a French specimen Pelletier did not find any at all.—*Codeia* sometimes reaches nearly one per cent in Turkey-opium (Mulder); in the finest qualities it does not surpass the fourth part of that proportion; in one very fine specimen I could obtain only a mere trace of this principle; and Merck could scarcely find a trace in Constantinople opium. In Garden-Patna opium I obtained fully one per cent. The other basic or neutral principles exist in unimportant proportions, except according to the analysis of Mulder, who represents Turkey-opium to contain sometimes so much Narcein as between six and thirteen per cent. It is difficult to estimate the proportion of *Meconic acid.* The last-mentioned authority found between four and seven and a half per cent in different specimens of Turkey-opium. It abounds in the Garden-Patna kind; and Merck found it also abundantly in the Egyptian variety.

To these observations it may be useful to add the following tabular view of the constitution of European opium, under different circumstances, and in comparison with Turkey-opium. This table, which is taken from an elaborate paper by Biltz in Buchner's Repertorium, xxxix. illustrates among other points the influence of

season, and the difference prevailing between the produce of different varieties of the poppy cultivated in Germany.

	Turkey opium.	German opium. White P. 1829.	Purple P. 1829.	Purple P 1830.
Morphia not quite pure	9.25	6.85	16.5	20.0
Narcotin	7.50	33.0	9.5	6.25
Meconic acid, impure	13.75	15.3	15.0	18.0
Bitter extractive	6.5	4.25	12.75	5.0
Extractive slightly bitter	15.5	6.75	7.0	35.
Deposit	7.75	2.20	3.75	4 75
Albumen and gluten	20.0	13.00	12.85	17.5
Balsamic oil	6.25	6.80	9.75	7.65
Gum, and a little lime	1.25	1.1	0.8	0.85
Caoutchouc	2.0	4.5	3.25	10.5
Sulphate of potash	2.0	2.0	2.5	2.25
Lime, Iron, Alumina, Phosphoric acid	1.5	1.15	1.5	1.85
Lignin and impurities	3.75	1.5	0.75	0.8
Ammonia, Volatile oil, Loss	3.0	1.6	4.1	1.1

In medico-legal researches the most important characters of opium or its preparations to be kept in view are the peculiar odour, the action of nitric acid on morphia, and that of the salts of iron on meconic acid. The odour is heightened, though also modified, by raising the temperature of a fluid containing opium to about 200°. When no odour is remarked on doing so, it is seldom possible to develop the remaining characters. These cannot be applied in the instance of organic mixtures without first making an aqueous extract, and then from this an alcoholic one. If the alcoholic extract present the peculiar bitterness of opium,—if its watery solution, when acted on by ammonia, cautiously added so as to avoid an excess, yields a precipitate which becomes yellow with nitric acid,—and if, after the separation of this precipitate, the remaining fluid gives with acetate of lead, a precipitate, which, when decomposed in water by sulphuretted hydrogen, imparts to the water the property of becoming deep cherry-red with sesquichloride of iron,—the evidence of opium being present is irrefragable. Other characters can seldom be obtained, owing to the prompt disappearance of the poison by absorption in the stomach; and indeed the same cause in the generality of instances removes the opium entirely beyond the reach of analysis. Merck's test, founded on a property of the principle porphyroxin, is to decompose the suspected substance in the fluid state by carbonate of potash,—to agitate the whole with ether,—to dip white filter-paper repeatedly in the ether, drying it after each immersion, and then to moisten the paper with muriatic acid, and expose it to steam from boiling water: A fine purple colour is produced. The applicability of this test to organic mixtures remains to be proved.

It will be necessary to add to the preceding observations on the chemical pharmacy of opium a few remarks on its officinal prepa-

rations, which have not been noticed hitherto in order not to interrupt the continuity of statement.

The purely mechanical preparations are the electuaries, plaster, pills, powder and lozenge. The *Electuarium*, E. or *Confectio opii*, L. D., a form little in use, is compounded with syrup and aromatics, and contains according to the Edinburgh formula a 43d, according to those of London and Dublin a 30th of opium.——The *Emplastrum opii* of the three Pharmacopœias also contains about a thirtieth of opium, and is used, occasionally with success, as a topical anodyne. The water directed in the London formula to be employed in making it is unnecessary if a vapour-bath be used, as ought always to be the case.——The *Pilula opii*, E. which contains a fifth of opium, has the advantage over the corresponding preparation of the two other Pharmacopœias, called *P. saponis composita*, L. or *P. saponis cum opio*, D.,—that, being made with conserve instead of soap, it may be kept longer in a soft state. But the *Pilula styracis* (*composita*, L.) of the three Colleges, which is of the same strength with the last two, is preferable to both, in as much as the taste and odour of the opium are completely covered by storax and saffron, so that it may be given without the patient necessarily knowing what he takes. It will be observed that the Edinburgh College orders less storax than the two other Colleges; but the quantity is sufficient, if the storax be used, as is advisable for ensuring its purity, in the form of alcoholic extract not too concentrated. The Edinburgh preparation is a four-grain pill, while that of London and Dublin must contain five grains to be of equal strength. Some difference will sometimes arise from the London College directing the opium to be used in the dried state, because some kinds contain a sixth of moisture. This injunction is at best needless; because the varieties, occasioned in the strength of different opiums by varieties in their chemical constitution in other respects, are far greater than those produced by variations in moisture. Moreover the opiums, which are otherwise finest and strongest, have at present the largest proportion of moisture; so that, as such samples cannot be got always, or by every one, the operation of drying all kinds of opium has the effect, not of diminishing, but of increasing the differences between them in activity. ——The *Pulvis cretæ compositus cum opio*, L. D. or *Pulvis cretæ opiatus*, E., a convenient form for use in cases of diarrhœa connected with acidity of the gastro-intestinal secretions, especially in children, contains about a fortieth of opium.——The *Trochiscus opii*, though contained only in the Edinburgh Pharmacopœia, is an indispensable form for the druggist, as it is much resorted to in all kinds of cough. Seven lozenges contain about a grain of opium.

The remaining officinal forms are chemical in their nature, as the natural constitution of the opium is more or less altered in preparing them. The *Extractum opii* of the three Pharmacopœias is

a preparation now little used, and for which pharmacy is indebted more to prejudice than to scientific investigation. The trouble required to make it is too great in reference to the objects it is intended to accomplish, namely uniformity and purification; and late inquiries show, that it cannot be made without the active principle morphia partly forming with the resinoid matter of the drug a compound nearly insoluble in all ordinary menstrua, and therefore probably not very soluble in the juices of the stomach.——The *Acetum opii*, D. E. is a favourite preparation with some, because it is thought less apt than the tinctures to produce the disagreeable subsequent effects of hypnotic doses. Acetic acid is one of the best solvents of the active constituents of opium; but the proportion in the Pharmacopœias, three parts and three-quarters of distilled vinegar to one of opium, is scarcely sufficient to exhaust the drug. ——The *Tinctura opii*, commonly called Laudanum, is made by all the Colleges with such proportions of the opium and spirit that thirteen minims and a half, or about twenty-five drops, contain the active part of one grain of opium. But the London tincture may sometimes be sixteen per cent stronger than the others, as dry opium is directed to be used. Laudanum is made in various ways. Few druggists practice the tedious maceration enjoined by the English and Irish Colleges The method suggested in the Edinburgh Pharmacopœia, by macerating the opium first in hot water, and then in rectified-spirit, in such proportions that the two fluids make proof-spirit when mixed, is the process usually followed in this city; and it may be completed in thirty-six hours. The tincture may also be made by percolation, if certain precautions be observed which are specified in the Edinburgh formula as an appendix. The tincture of the shops is very often adulterated. Good tincture should leave when thoroughly dried up in the vapour-bath, from 17 to 22 grains of residuum for every fluidounce; but I have several times found it so low as 10 or 7 only.——The *Tinctura opii camphorata*, E. D., or *Tinctura camphoræ composita*, L., the English Paregoric of common speech, is one of the compound tinctures much used in coughs, and in which camphor, together with aromatics, has been supposed to counteract the debilitating action of opium on the stomach. The active matter of one grain is contained in 240 minims or about 450 drops of the Edinburgh tincture and in 267 minims or about 500 drops of that of the two other Colleges.——The *Tinctura opii ammoniata*, E. commonly called Scotch Paregoric, must be carefully distinguished from the last, because it is three times as strong, the activity of one grain of opium being possessed by 80 minims or about 150 drops. It is believed to possess the same advantages with English Paregoric over laudanum, and is used for similar purposes. It is not an unchemical preparation, as some imagine; because the ammonia is in excess, so that morphia is dissolved. The spirit of ammonia, which is used as the solvent, must be the caustic spirit of the Edinburgh

College, not the spirit of carbonate of ammonia of the other Colleges, which does not dissolve morphia. Some critics, who have underrated the Edinburgh preparation, appear to have overlooked this circumstance.——The *Vinum opii*, though little used except outwardly, as in chronic ophthalmia attended with irritability, is a good preparation also for internal use; and, like the last two preparations, it seems, in virtue of the aromatics it contains, to be less apt than laudanum to disorder the stomach. Seventeen minims of the Dublin wine contain the virtues of one grain of opium. That of Edinburgh was intended to be of the same strength, because the Dublin College was the first to adopt this preparation; but the quantity of menstruum is a trifle greater. The London College, by adhering to the use of extract of opium instead of the crude drug, produce a stronger preparation, of which ten minims represent a grain of opium.——The *Enema opii* is made by adding the common tincture to water (D.) or more conveniently to starch-mucilage (E. L.) There is decided advantage in administering an opiate clyster in small bulk; for it is thus less apt to be discharged through the stimulus of distention. The water ordered in the Dublin Pharmacopœia is clearly too much; and even the London proportion may be conveniently reduced.——The *Linimentum opii*, E. L. or *Linimentum saponis cum opio*, D., the best form for an anodyne embrocation, contains about a fourth of laudanum according to the London Pharmacopœia, and is nearly twice as strong, in the processes of the two other Colleges. The difference is unimportant, as the liniment is never used internally.

In addition to the officinal forms of opium, notice may be also taken of two nostrums at present deservedly in much repute and demand, called the Black-drop and Sedative solution. The *Black-drop*, a preparation long used in Britain, is certainly less apt to occasion the subsequent and idiosyncratic effects of opium, which many people suffer from taking the ordinary officinal preparations. It is said to be an infusion of opium, saffron, and nutmeg in verjuice, afterwards fermented with the aid of sugar, and then concentrated to the consistence of thin syrup (Armstrong on Fever, 2d Edition). The only objection to it is its high price. It is twice as strong as laudanum,—not four times, as the patentee alleges.—The *Sedative solution* of Battley is a more recent invention, not inferior to the black-drop, and much cheaper. The inventor says it is prepared with water and heat alone (Pereira); but this method will scarcely account for the disappearance of meconic acid, which I have found to be diminished to a twelfth of what is contained in watery infusions of the same strength. It is not so strong as is commonly represented: Twenty minims are equal to not more than thirty of laudanum, or about fifty-two drops.

Adulterations.—The adulterations of opium constitute a subject of much importance, but of great obscurity. They are practised before the drug is imported into this country. Stones, sand, dust,

oil, extract of poppy, other vegetable extracts, and a variety of substances besides, have been mentioned as in common use for the purpose. Some of these impurities may be discovered simply by careful ocular inspection. But others cannot be so found out. And when it is considered that the drug also differs naturally in energy according to circumstances of climate, soil, cultivation, and the like, it must be evident that the detection of impurities, and, in more general terms, the determination of its relative value, must be difficult problems to solve in any way. Practical druggists rely almost entirely on external characters, such as colour, odour, taste, texture, moisture, and freedom from mechanical admixture. These in experienced hands are in general sufficient. But without great practice they constitute fallacious criterions; and I have repeatedly known even experienced persons egregiously deceived. On one occasion in particular, which came under my notice, one of the first houses in London supplied to a skilful manufacturer in Edinburgh nearly two hundred-weight of opium, which was believed by both parties to be of the finest quality for making muriate of morphia, and which nevertheless did not contain above two-thirds of the average produce. He who trusts to external characters will seldom go wrong, if he purchase as fine opium, that variety which has been described above as the superior Smyrna sort. Yet I have found, that opium may deviate from the characters there laid down, being for example dark, hard, dry, and not covered with rumex seeds,—and nevertheless be of excellent quality.

Various attempts have been therefore made to furnish the skilful and unskilful alike with some chemical and less fallible criterion. But unfortunately no method, at once trustworthy and easy, has hitherto been suggested. A method, based on the property possessed by meconic acid of forming a cherry-red solution with ferruginous salts, has been several times proposed; but some years ago I ascertained, that the proportion of meconic acid does not bear a fixed relation to the value of opium in morphia or in any other shape. Others have proposed as a criterion the weight of precipitate obtained by ammonia from an infusion of a given quantity of the opium; but this precipitate contains variable proportions of colouring resin and narcotin. The Edinburgh Pharmacopœia substitutes the weight of the precipitate caused in an infusion by a large excess of carbonate of soda. This precipitate contains the whole morphia and narcotin, and less colouring matter than when ammonia is used. It can scarcely be a correct criterion of relative quality generally. But in the mode the College has applied it, it probably furnishes a tolerably good test, whether a given specimen of opium comes up to a specific standard. The standard assumed by the College is, that the precipitate shall amount to a tenth of the opium.——After many trials of these and other published methods, as well as some more that have occurred to me, I am inclined to think the only sure criterion is one neither

easy, expeditious, nor applicable on a sufficiently small scale for ordinary use,—namely, the preparation of pure muriate of morphia by Dr Gregory's process. With good opium, and applied to about a pound of it, this process ought to yield at least ten per cent of snow-white salt. It has been recently stated, that no kind of opium except the finer Turkey sorts, contains morphia in the state of sulphate, and consequently that no other infusion of opium will yield a precipitate of sulphate with salts of baryta, or at least more than a cloudiness (Batke). This fact, if correct, may be made the basis of a simple criterion of quality.

Actions and Uses.—Very contradictory accounts continue to be given of the actions of opium. But the apparent contradictions vanish, on attending to the influence of collateral agents in modifying its effects. It is in various circumstances a narcotic, anodyne, hypnotic, and calmative, a stimulant and a sedative, a diaphoretic, and an inspissant of the mucous secretions. These are its ascertained physiological actions. Therapeutically, it is an antispasmodic, febrifuge, antidysenteric, antihysteric, &c.

Topically it is a direct stimulant and indirect sedative both of the nervous and vascular systems. An infusion dropped into the eye in chronic ophthalmia, for example, at first increases pain and redness; but these effects are speedily followed by departure of pain, diminished vascularity, and inferior sensibility to the action of other more powerful stimulants. As a local agent it seems to be a direct sedative of the muscular system; for when applied to the intestines or external muscles, motion is impaired or arrested, and without any previous muscular excitation.

Its remote actions are more difficult to trace. A large dose swallowed produces depression of the functions of the brain,—bluntness of the external senses and obscurity of the faculties of the mind, gradually passing to profound stupor; and it is rare that exaltation of the mental powers, or increased acuteness of external sense precedes these effects. In general the whole nervous system connected with sensation and motion is at the same time in a state of flaccidity or paralysis. But often in certain orders of the lower animals, very rarely however in man, the voluntary muscles are on the contrary thrown into a state of violent involuntary excitement or convulsions. The circulation in the early stage of this variety of action is for the most part excited, the pulse being firm, fuller and more frequent. But the excitation is seldom great, and it quickly gives place to depression; so that the pulse becomes small, soft, and often slow. The theory of this influence on the heart and bloodvessels seems to be, that the action of opium on them is primarily and essentially stimulant, but that the stimulus is promptly overwhelmed through the medium of the depressed state of the functions of the brain.——The action of large doses, now described in general terms, constitutes opium a powerful and pure narcotic poison, and when completely established, is indicated

by torpor, at first susceptible of interruption, flaccidity of the extremities, slow, soft respiration, paleness of the features, excessively contracted pupils, coldness of the limbs, generally retention of urine, sometimes profuse perspiration, and occasionally an opiate odour of the breath. For the most part, this state ends fatally, unless soon relieved; but few cases are lost, if the proper remedies be promptly and unremittingly resorted to. These remedies are emetics or the stomach-pump,—external stimulants, such as loud talking, shaking by the shoulders, the application of ammonia or strong acetic acid to the nostrils, or the injection of tepid water into the ears,—and likewise internal stimuli, the best of which are brandy and carbonate of ammonia. In desperate circumstances life has been occasionally saved by galvanism, or by artificial respiration. If consciousness be once fairly restored, forced exercise, after the stomach has been emptied, commonly completes the cure.

The action of opium in small doses is much more variable. When taken for medicinal purposes, it first produces some excitement of the pulse and increased heat of the body. After an interval, varying from fifteen to sixty minutes, slight fulness in the head is felt, with numbness in the limbs, disinclination to stir, indisposition to attend to the impressions of external sense, a succession of vague, fleeting ideas, and the departure of pain. Sleep soon succeeds, and continues for six or eight hours; and this is followed for some hours longer by listlessness, giddiness, and languor of the pulse, or sometimes also sickness, want of appetite, and headache. Throughout the progress of these effects the mucous secretions are suspended, constipation is induced, the cutaneous secretion is increased, and the secretions of urine and bile are unaffected, or inspissated merely, in consequence of their discharge being impeded. The state of constipation usually continues for two days or upwards; and sometimes too the retention of urine from debility of the bladder is not got rid of entirely for some time.

Such are the most general effects of medicinal doses of opium when the individual composes himself to sleep. But if the first approaches of drowsiness be successfully resisted, the tendency to sleep soon passes off in many persons; and—the pulse continuing full and firm, while pain, as well as other uneasiness, takes its departure,—the faculties become clear, the ideas brilliant, precise, and under control, the power of application more intense, the conversational energies improved, and the muscular movements facilitated. After some hours a stage of drowsy listlessness ensues, as after the hypnotic operation of the drug. During the prolonged excitement of the nervous system here described, it seems probable that the particular manifestations of the excitement are directed partly by constitutional peculiarities, but occasionally too by an effort of the will. And thus, one man becomes a lively, conversable member of his social circle, another applies with energy to the labour of literary composition, another in placid indifference to

every thing around, indulges in a trip to the realms of fancy, and another, turning his mind to the expression of what is passing within him, performs a series of extravagant, irregularly connected acts, presenting in some measure the phenomena of intoxication. These singular varieties in the action of small doses sometimes originate in constitutional peculiarities. But this is probably not so often their real cause as is commonly thought. They may be sometimes satisfactorily referred to the effect of an original impulse of volition. I have known most of them to be produced in different circumstances in the same individual.

Other varieties still, are produced in the effects of medicinal doses of opium, by peculiar constitutional states. The most common is a simple aggravation of the unpleasant symptoms that often follow sleep,—namely, dry tongue and thirst, headache, nausea, vomiting, if the erect position be assumed, languor, discomfort, and undefinable misery. These symptoms are so frequently met with in medical practice, as to be generally called the subsequent effects of opium. Although they often depend on obscure constitutional causes, they may also arise from the opium having been taken soon after a meal, while the stomach is full of undigested food, or disordered by indigestible food or habitual dyspepsia. They may sometimes be prevented in those subject to them by substituting opium-vinegar, the black-drop, the sedative solution, or above all, the muriate of morphia, for the more ordinary preparations. They are best combated by lemon-juice, strong coffee, or especially brandy, and by the patient breakfasting before he attempts to get up.——Another constitutional peculiarity from medicinal doses is, that, instead of sleep or calm reverie, a feverish state ensues, with frequent pulse, headache, watching, restlessness, starting disagreeable visions, even delirium, anxiety, and afterwards an aggravated degree of the more familiar subsequent effects of the drug. These phenomena constitute what is sometimes called the Idiosyncratic action of opium. Though commonly the result of idiosyncrasy, I have known it induced in those with whom opium in general agreed, if they happened to take it in too large a dose, or soon after a full meal with more than an ordinary allowance of wine.——A third peculiarity is excessive sensibility to the action of opium; as in the instance of a friend of my own, with whom the fourth part of an ordinary dose is sufficient to act as a hypnotic. Young infants present always this constitutional state; so that a single drop of laudanum may prove a dangerous dose to a child a few weeks old.——A fourth, but much rarer peculiarity, is excessive insensibility to its action. A gentleman of my acquaintance, not accustomed to its use, has taken 450 drops of the best laudanum without any other effect than some headache and constipation; and, singularly enough, his son at the age of six took 60 minims of solution of muriate of morphia without any apparent effect at all.——Perhaps the most remarkable of all the constitutional peculiarities connected with the

operation of this wonderful drug, are those dependent on the influence of habit. Habit blunts in every one the sensibility to the action of opium; so that its dose, when often repeated, must be progressively increased to attain the same end. This is particularly observed of Opium-eaters, as they are commonly called, or those who take it habitually for its stimulant action on the nervous system. Three ounces of laudanum are a common daily allowance, and an ounce a frequent dose after long indulgence in this vice; nine ounces a-day have been taken by some; and an instance is known where twice that quantity was consumed for several weeks together. The usual effect of the Opium-eater's dose is controsedative,—if a term may be invented for an action hitherto but little studied in medical practice. That is, it simply removes the state of exhaustion, languor, and misery consequent on his previous debauch; and renders him active, alert, sprightly in conversation, but by no means necessarily extravagant. The ultimate effect is disorder of the stomach, sallowness of complexion, premature senile expression, a decrepit form of the body, and probably shortening of life. But the precise injury done to the constitution has not yet been ascertained; and some live under such habits to an advanced age. It is worthy of remark that such persons do not in general suffer from constipation. It has been stated that the catamenia are slowly arrested.

The action of opium is greatly modified by certain states of disease. There are scarcely any diseases which materially increase the sensibility to its influence. But its narcotic power is lessened in the advanced stage of pneumonia or peritonitis, by profuse hemorrhage, especially from the uterus, by severe dysentery, delirium tremens, some varieties of mania, tetanus, and hydrophobia, and severe pain or spasm of any kind.——It is also modified by the conjunction of other remedies. Camphor is thought to diminish the chance of its subsequent or idiosyncratic effects. Tartar-emetic is thought by some to have the same tendency, and not without reason. But the most important ascertained modification is what takes place from the conjunction of ipecacuan. Three, four, or sometimes even six times the ordinary hypnotic dose may then be given without inducing sleep; and on the other hand sweating is brought on with much greater certainty (see *Ipecacuanha*).

Opium exerts its remote action on the brain, through whatever channel it is introduced into the body,—through the stomach, the rectum, a wound, a vein, an excoriation, a blistered surface, or even the unbroken skin where it is tender. It acts most energetically when it is most promptly absorbed. Nevertheless it cannot be detected in the blood,—probably because the means of discovering it, at present possessed by chemists, are not delicate enough. It is conceived in some continental countries, especially in France, that it acts three or four times more energetically through the rectum than by the stomach. This must be an error; for in Britain it is

not uncommon to give 60 minims of laudanum or four grains of opium by the rectum,—doses, which, according to the French view ought to occasion always alarming symptoms, and sometimes even death. Although the external surface of the body is not a ready channel for the introduction of opium, nevertheless patients, to whom laudanum is freely applied for allaying the pain from a blistered, excoriated, or inflamed surface, ought always to be attentively watched; for dangerous accidents have sometimes happened in this way. Opium would appear also to exert its action when introduced in the form of smoke into the lungs. This is the mode at least, in which it is often used in China, and apparently with the same effects as when it is swallowed. Yet opium is known to be decomposed by such a heat as is necessary in the process of smoking a pipe: neither are any of its active principles volatilizable And I may add that several of my pupils have tried the process with a Chinese pipe and Chinese extract, but experienced no other effects than severe headache and sickness.

The special uses of opium are so numerous that it is impossible to do more here than mention the most important of them. Given in a large dose at the commencement of the cold stage of a fit of ague it often arrests the paroxysm. In typhus, when there is excessive watchfulness, and restlessness, without redness of the features or injection of the conjunctivæ, it is often useful as a hypnotic, more especially if united with tartar-emetic. Along with calomel in frequent doses, such as a grain of opium with three grains of calomel every six, four, or even three hours, it is a powerful remedy in the advanced stages of pneumonia, pleurisy, peritonitis, and other acute inflammations; and even alone, in frequent large doses, such as two grains every six hours or oftener, it is often useful in the advanced stage by strengthening without accelerating, the pulse, and so rendering farther evacuations practicable. When used in a single large dose, immediately after free venesection in the commencement of acute inflammation, such as pneumonia, peritonitis, and nephritis, the force of the disease is often effectually and permanently broken, or even a cure accomplished without farther treatment. In gastritis and enteritis it is also given to allay vomiting. With ipecacuan as a sudorific, it is the best of all means for arresting febrile cynanche tonsillaris and febrile catarrh in the incipient stage; and the same measure, after free blood-letting, is the best mode of treating acute rheumatism. It is the most effectual palliative for chronic rheumatism and neuralgia; and indeed this property is what leads oftener than any other circumstance to the habit of opium-eating. It is often necessary in large doses for allaying the pain of gout; and is held by some to cure the fit safely, if used in frequent doses of a grain till slight narcotic effects show themselves. In the secondary stage of small-pox it is valuable for subduing irritation. It is an important remedy for allaying the nervous irritability which attends profuse hemorrhagies,—especially

uterine hemorrhage; and large doses of 40, 60, or 80 minims of the tincture are required. An ordinary catarrh may be often arrested at the commencement by a full opiate; so may a coryza or common cold in the head; and dysentery, acute as well as chronic, may be frequently cured by nothing else than the assiduous alternate use of opium and mild laxatives. In violent dysentery, especially during epidemic visitations of it, large doses are required, such as ten, twenty, or even thirty grains in twenty-four hours. It allays the tortures of rabies canina and of tetanus,—is the best of all anti-hysteric remedies, especially along with an equal dose of sulphuric ether,—often checks the asthmatic paroxysm when given either with ether or singly,—will usually and promptly put an end to colic, both common and lead colic, particularly if it be alternated with a laxative,—and is the readiest of all means for arresting ordinary cholera and diarrhœa, if attention be also paid to the subsequent removal of acrid ingesta. It is the most important of all adjuncts to an animal diet in the treatment of diabetes, and is given commonly twice or thrice a-day for this purpose. It is the most approved of all remedies in delirium tremens; in which it must be given for some days continuously at intervals of six, eight, or twelve hours, and in large doses, according to its effects. It likewise acts similarly in some forms of mania that approach to delirium tremens in their characters. As an anodyne and calmative it is given in most forms of irritant poisoning, after the poison has been removed from the stomach. As a palliative opium is useful in a thousand morbid states, for soothing pain, allaying cough, calming irritability, or obtaining sleep.

Externally it is employed chiefly to subdue pain, as in the form of opiate liniment or opiate plaster for neuralgia and chronic rheumatism, in that of lotion or ointment for painful chronic diseases of the skin, in the form of poultice sprinkled with laudanum for soothing irritable blistered surfaces, especially where the scrotum is the affected part, and as a lotion in erythematic and erysipelatous inflammation. Many dread the use of opiate applications in erysipelas, from the fancied risk of repelling the eruption. But this is a visionary fear; and both in erythema and in all kinds of erysipelas, even idiopathic erysipelas of the face, the best of all applications, not merely for allaying pain, but likewise for arresting the local inflammatory action, is a lotion made by preparing an infusion of 32 grains of opium and a solution of as much acetate of lead, each in four ounces of water, and then adding the solutions and filtering the mixture to separate the insoluble meconate of lead.

The physiological actions of opium are owing in a great measure to its morphia. The actions and uses of Morphia, which closely resemble those of the crude drug, have been described under a separate head (see *Morphia*). It is an anodyne, hypnotic and narcotic; and the chief difference observed between it and opium in their effects is, that the phenomena, which constitute the subsequent

and idiosyncratic actions of opium, are much less apt to be produced by its alkaloid.—Narcotin was at one time thought to be a stimulant narcotic, and to be the cause of the irregular actions just alluded to as sometimes overwhelming, but more generally following, the hypnotic effects of medicinal doses of opium. This doctrine however is doubtful; and it would appear that narcotin is physiologically a rather inert substance. Not long ago it was proposed as a substitute for cinchona-bark and sulphate of quina in the treatment of ague and remittent fevers; and very favourable results have been recently obtained from extensive trials made with it in the East Indies (O'Shaughnessey).—Different accounts have been given of the effects of Codeia. Dr Gregory found it to be a stimulant of the nervous system in the dose of five or six grains, and that the stimulus was succeeded by depression, sickness, and headache. It has been found an excellent anodyne in gastrodynia in a dose varying from a quarter of a grain to two grains; and it has seemed to me a hypnotic in the dose of three or four grains. Narcein and meconin appear inert. Paramorphin is said by Magendie to act like strychnia,—producing tetanic spasms without stupor. Meconic acid is inert, at least in doses of twelve grains.

The officinal forms and doses of opium are these: *Opium*, gr. i. ad gr. iii.—*Confectio opii*, L. D., *Electuarium opii*, E., dr. ss. ad dr. i.—*Extractum opii*, gr. ss. ad gr. ii.—*Pilulæ opii*, E. gr. v. ad gr. x. —*Pilulæ saponis compositæ*, L., *Pilulæ saponis cum opio*, D., gr. v. ad gr. xv.—*Pilulæ styracis*, E. D., *Pilulæ styracis compositæ*, L. gr. v. ad gr. xv.—*Pulvis cretæ opiatus*, E., *Pulvis cretæ compositus cum opio*, L. D., gr. v. ad dr. ss.—*Trochisci opii*, E., vi. ad xii.—*Acetum opii*, E. D., m. x. ad m. xxx.—*Tinctura opii*, m. xv. ad m. xlv.—*Tinctura opii camphorata*, E. D., *Tinctura camphoræ composita*, L., fl.dr. i. ad fl.unc. ss.—*Tinctura opii ammoniata*, E., fl. dr. ss. ad fl. dr. ii.—*Vinum opii*, m. xv. ad m. xlv.

For external use: *Emplastrum opii.*—*Linimentum opii*, E. L.—*Linimentum saponis et opii*, D.—*Unguentum gallæ et opii*, E.—*Unguentum gallæ compositum*, L.

OPOPONAX, *L. D.* *Gum-resin of Opoponax Chironium, DC. (Lond.)*; *of Pastinaca Opoponax, L.* *Opoponax.*

FOR. NAMES.—*Fren.* Opopanax.—*Ital. Span.* and *Port.* Opopanaco.—*Ger.* Panax ; Opopanax.

FIGURES of Opopanax Chironium in Nees von E. 292.—St. and Ch. ii. 98.

DIOSCORIDES has given a good account of this gum-resin under the name of Ὀποπάναξ, which he says was obtained from the Πάνακες Ἡρακλεῖον, a native of various parts of Greece and of Lybia.

The plant is the *Opoponax Chironium* of Koch, Decandolle, and Lindley, the *Pastinaca Opoponax*; or *Ferula Opoponax* of other botanists. It belongs to the Natural family *Umbelliferae*

and to Linnæus's class and order *Pentandria Digynia.* It is an inhabitant of the greater part of the south of Europe. When the root is wounded, a whitish juice escapes, which hardens into a firm gum-resin, the Opoponax of the shops. It occurs in reddish-yellow tears or irregular masses; possesses a rather fetid odour, and a bitter acrid taste; and consists chiefly of resin and gum, with 6 per cent of volatile oil, and a little starch, extractive, waxy matter, lignin, and malic acid (Pelletier). Like the other fetid gum-resins from the same family of plants, such as assafœtida, ammoniac, and galbanum, it readily forms an emulsion with water. It possesses the physiological properties common to these analogous gum-resins; but it is now scarcely ever used in this country, and has therefore been properly omitted in the last Edinburgh Pharmacopœia.

ORIGANUM, *E. L.* ORIGANUM VULGARE, *D.* *Herb (and volatile oil, D.) of Origanum vulgare, L. W. Spr. Common marjoram.*

ORIGANUM MAJORANA, *D.* *Herb of Origanum Majorana, L. W. Spr. Sweet marjoram.*

OLEUM ORIGANI, L. D.

PROCESS, *Lond. Edb.* To be prepared from Origanum according to the general directions for distilling volatile oils. (See *Introduction.*)

FOR. NAMES.—*Origanum vulgare.* *Fren.* Origan.—*Ital.* Origamo; Origano.—*Span.* Oregano.—*Port.* Ourégão.—*Ger.* Gemeiner dosten; Wohlgemuth.—*Dut.* Orego.—*Swed.* Dosta.—*Dan.* Vild maran; Tostkonning.—*Russ.* Dushitza obiknovennoi; Materinka.

Origanum Majorana.—*Fren.* Marjolane.—*Ital.* Majorana.—*Span.* Mejorana.—*Port.* Mangerona.—*Ger.* Majoran.—*Dut.* Mariolein.—*Swed.* Mejram.—*Dan.* Maran; Meran.—*Arab.* Mirzanjoosh.—*Tam.* Maroo.

FIGURES of Origanum vulgare in Engl. Bot. 1143.—Hayne, viii. 8.—Nees von E. 175.—Of Origanum Majorana in Hayne, viii. 9.—Nees von E. 176.

SEVERAL species of ORIGANUM were probably used by the Greeks, certainly at least two, the Οριγανος and Αγριοριγανος of Dioscorides,—which have not been exactly identified in modern times.

Natural History.—*Origanum vulgare*, or common marjoram, is an indigenous perennial plant, belonging to the Linnæan class and order *Didynamia Gymnospermia*, and to the Natural family *Labiatæ.* It grows in dry gravelly places and on roadsides. It flowers in July and August. The whole plant has a strong, peculiar, rather agreeable, balsamic odour, and a warm, bitterish aromatic taste; both of which properties are preserved when the plant is dried. It yields by distillation with water a small quantity of a reddish volatile oil, which may be seen in vesicles on holding up the leaves between the eye and the light, and which is the principal source of its properties as a medicinal agent. This is the *Oleum origani* of the Pharmacopœias, sometimes incorrectly called oil of Thyme.

Origanum Majorana, or sweet marjoram, an annual species of

finer fragrance, grows naturally in Portugal, Greece, Palestine, and India; and it is also often cultivated in gardens in this country. It flowers a month earlier than the last species. Its odour is stronger and more agreeable, and its taste more camphoraceous. Both properties are retained in the dried plant. They are owing to a yellowish volatile oil.

Actions and Uses.—The marjorams are used chiefly in the form of infusion for making fomentations; but they may also be employed internally as stimulants and carminatives. They were esteemed by the Greeks as remedies for narcotic poisoning, convulsions, dropsy, and amenorrhœa. The oil of common marjoram is an ingredient of some embrocations in vogue in England; and it is also made use of as a topical remedy for toothache.

The dose of the only preparation, the *Oleum origani*, L. D. is min. v. ad min. xv.

OSSA, *D.* *Bones.*

BONES when thoroughly cleaned consist in a great measure of bone-earth and gelatin. The former constituent is an article of the Materia Medica for therapeutic, the latter for dietetic, purposes.

Chemical History.—Bone-earth constitutes about sixty per cent of dry bones; and it is itself composed of about five parts of phosphate of lime to one of carbonate of lime, with a minute proportion of other salts. It is obtained by incinerating bones, especially the shafts of the long bones, in an open fire-place at a red heat. A white stratiform substance is obtained, which, if the heat were not too high, is pulverizable without much difficulty, and entirely soluble in muriatic or nitric acid. It is used for preparing the *Phosphas calcis precipitatum* and *Phosphas sodæ* of the Pharmacopœias.

Bone-gelatin is obtained by carefully cleaning and boiling bones in water, in order to remove fat, membranes, and other impurities,—immersing them for ten days in commercial muriatic acid diluted with four times its volume of water,—replacing this liquid for twenty-four hours more with water merely acidulated with muriatic acid,—and then elutriating the residuum with pure water, frequently changed till it comes off tasteless. The bone-earth is thus all removed, and little remains but gelatin, which is fit for every purpose to which other forms of this principle are applied. Bone-gelatin has long been extensively prepared in France as a convenient and cheap article for making soups. But a late report by a committee of the French Institute, founded on experiments on animals carried on for several years, has stated as the conclusion that this substance is not only not nutritive but even positively prejudicial to nutrition (Comptes Rendus, 1841.)

Bones are also employed for preparing the variety of animal charcoal, called in trade Ivory-black, or more correctly Bone-black,

the *Carbo animalis* of the Edinburgh and London Pharmacopœias. This substance is obtained by heating bones in close vessels at a red heat till vapours cease to be disengaged. It consists of charcoal and bone-earth. It possesses in a remarkable degree the property of decolorizing vegetable fluids;—for which and other properties see the article *Carbo.*

OVUM, *E. L. D.* *The Egg of Phasianus Gallus.*

FOR. NAMES.—*Fren.* Oeuf.—*Ital.* Uovo.—*Span.* Huevo.—*Port.* Ovo.—*Ger.* and *Dut.* Ei.—*Swed.* Hönsägg.—*Dan.* Honseæg.—*Arab.* Baygah.—*Tam.* Korag mootay.

THE *Phasianus Gallus* or common fowl is domesticated in every quarter of the globe, and presents an infinite number of varieties, of which, according to some, the Jungle-fowl of India may be considered the original.

Chemical History.—Its egg is an important article of the Materia Medica, both in a pharmaceutic and dietetic point of view. It consists of a shell, a lining membrane, white or albumen, and yolk or yelk. The Shell being composed in a great measure of carbonate of lime, has been long employed as an antacid, but is now little in use. The White is a glairy colourless transparent fluid enclosed in delicate membranous cells, and composed of 12 per cent of albumen, 2.7 mucus, 0.3 saline matter, and 85 water (Gmelin). When beat up with a little water and filtered, it presents all the characters of a solution of albumen; and in particular it is permanently coagulated by a heat somewhat under 212°, and is precipitated by corrosive sublimate. The Yolk is a thick opaque yellow fluid, consisting of about 54 per cent of water, 17 of phosphoretted albumen, and 29 of oil (Prout). It also contains a peculiar yellow colouring matter, and cholesterin, and a complex viscous substance containing combined phosphorus (Gobley). The oil is composed of eleven parts of elaïn and one of stearin.

Uses.—The white and yolk of the egg collectively constitute a nutritive article of food, exceedingly serviceable in the sick-room. With some persons however eggs constantly disagree, causing indigestion, flatulence, and often vomiting. The white of egg is an important remedy as a demulcent in diseases of the alimentary mucous membrane, and as an antidote for certain kinds of poisoning, more especially with corrosive sublimate, or the soluble preparations of copper. It is a good external remedy in cases of redness or excoriation from pressure, for which purpose it should be applied frequently with a feather in the form of a liniment made by agitating it briskly with its own volume of rectified-spirit. It is much used for clarifying spirituous liquids, which it accomplishes by undergoing coagulation, and enveloping suspended impurities in its flakes. Watery liquids may be clarified in the same way with the aid of heat. It may be also advantageously resorted to, as a suspending agent, for administering some powdery insoluble drugs in the

form of mixture. Yolk of egg is more available however for the latter purpose, and answers very well for converting oils and resins into the form of emulsion. In particular it is one of the best articles for giving this form to copaiva. The oleaginous part of the yolk, separated after coagulation by means of pressure between heated plates, constitutes the Egg-oil of some foreign Pharmacopœias. It is thought by some to be a useful application for excoriated nipples, and by others it is said to diminish the scars of small-pox, when smeared over the pustules before and during encrustation.

It is said to facilitate the extinction of mercury by trituration.

PAPAVER, *E. L.* PAPAVERIS SOMNIFERI CAPSULÆ, *D.* *Ripe (not quite ripe, E.) capsules of Papaver somniferum, L. W. DC. Spr. Poppy-heads.*

DECOCTUM PAPAVERIS, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Poppy-heads, sliced, four ounces;
Water, three pints (four, L., two old wine-pints, D.);
Boil for fifteen minutes and strain.

EXTRACTUM PAPAVERIS, L. E.

PROCESS, *Edin. Lond.* Take of
Poppy-heads, without seeds (bruised, L.), fifteen ounces;
Boiling water (distilled, L.), a gallon;
Macerate for twenty-four hours; boil down to four pints; filter the liquor hot; and evaporate (in the vapour-bath, E.) to the due consistence.

SYRUPUS PAPAVERIS, E. L. D.

PROCESS, *Edin Lond.* Take of
Poppy-heads, without seeds, a pound and a half (three pounds, L.);
Boiling-water, 15 pints (5 gallons, L.);
Sugar, three pounds (five, L.);
(Slice the poppy-heads, and infuse them for twelve hours in the water, E.)
Boil down to five pints (2 gallons, L.)
Strain and express strongly through calico. Boil again to two and a half (four, L.) pints. (Strain again; let the impurities settle for twelve hours, and boil down the liquor to two pints, L.) Then add the sugar, and dissolve it with the aid of heat.

PROCESS, *Dub.* Take of
Dried poppy-heads, without seeds and bruised, seventeen ounces;
Boiling water, two gallons;
Macerate for twenty-four hours, evaporate in the vapour-bath to one gallon, and express strongly. Concentrate the strained liquor to two pounds, and strain it again while hot. Let the impurities settle for twelve hours. Boil down the liquor to a pound, and make it into a syrup.

FOR. NAMES.—*Fren.* Pavot.—*Ital.* Papavero.—*Span.* Adormidera blanca.—*Port.* Dormiderias.—*Ger.* Weisser mohn.—*Dut.* Maankop.—*Swed.* Wallmo.—*Dan.* Hoid Valmue.—*Russ.* Mak usipitelnoi.—*Arab.* Khushkhash.—*Pers.* Kooknar. —*Tam.* Casa casa.—*Hind.* Post.

FIGURES of Papaver somniferum in Nees von E. 405.—Hayne, vi. 40.—Steph. and Ch. i. 31.—Roque, 136.

Natural History.—THE history of the *Papaver somniferum* has been already given in a great measure under the head of Opium. It is the common cultivated poppy, of which there are at least three varieties, the white, red, and purple poppy. Its capsules, commonly called Poppy-heads,—the only officinal part besides opium,—are obtained for the most part from the white variety, because these are the largest. They ought to be gathered, as the Edinburgh

Pharmacopœia directs, before they are entirely ripe. They abound at that period with the milky juice of which opium is made; but, if allowed to ripen before being plucked, as the two other Colleges have directed, this juice is in a great measure exhausted. The seeds, which are very numerous, ripen well enough although the capsules be cut while greenish and juicy.

The seeds of the poppy are oleaginous and emulsive, and yield by expression a large quantity of a yellowish fixed oil, which dries up into a varnish on being exposed for a length of time to the air. Both the seeds and the oil are quite bland and without narcotic properties; and consequently they may be taken as food with impunity. But the capsules possess the peculiar bitterness and narcotic qualities of opium. They yield their virtues readily to water; with whose agency are obtained the *Decoctum*, *Extractum*, and *Syrupus papaveris* of the Pharmacopœias. These preparations probably all contain a little morphia. Winckler got 20 grains of pure morphia from 32 ounces of the capsules; and Petit detected it in the extract. All the preparations of the capsules however are very irregular in strength; which may depend partly on differences in the variety of plant used, partly on the period at which the capsules are plucked, and partly too on deviations from the correct pharmaceutic processes.

Actions and Uses.—Poppy-heads, with their preparations, possess all the properties of opium. The syrup and extract, which are used internally, have been thought by some to be less liable than opium to the disadvantage of causing headache and sickness after their hypnotic action, or restlessness, fever, and anxiety instead of it. But this superiority is far from being well established. The extract, the Μηκώνειον of the ancient Greeks, is now little employed, except perhaps for adulterating opium. But the syrup is still frequently given to children. Owing however to its irregular strength, it has sometimes occasioned dangerous accidents; so that, if a syrup is necessary at all, it would be better that the Colleges substituted a syrup of opium, which would have the advantage of greater uniformity. Decoction of poppy-heads is much in use as an emollient and anodyne for fomentations. It is probable that it does not possess greater virtues than other mucilaginous decoctions.

The doses of the preparations of poppy-heads are: *extractum papaveris*, gr. i. ad gr. x.—*Syrupus papaveris*, unc. ss. ad unc. ii. —*Decoctum papaveris*, for external use.

PAPAVER RHOEAS, *D.* See *Rhoeas.*

PAREIRA, *E. L.* *Root of Cissampelos Pareira, L. W. DC. Spr. Pareira.*

EXTRACTUM PAREIRAE, E. L.

PROCESS, *Edin. Lond.* This extract is to be prepared from Pareira root in the same way as Extract of Gentian.

INFUSUM PAREIRÆ, E. L.

PROCESS, *Edin. Lond.* Take of Pareira, six drachms; Boiling water, one pint; Infuse for two hours in a covered vessel, and then strain through linen or calico.

FOR. NAMES.—*Fren.* and *Ital.* Pareira brava.—*Port.* Abutua; Pareira brava. —*Ger.* Grieswurzel.

FIGURE of Cissampelos Pareira in Woodville, Med. Bot. t. 82.

THIS root, which was admitted for the first time into the last editions of the London and Edinburgh Pharmacopœias, has nevertheless been an article of the European Materia Medica for urinary complaints since the close of the seventeenth century, when it was made known by Maregrav and Piso in their Natural History of Brazil.

Natural History.—Though referred by the Colleges to *Cissampelos Pareira*, doubts have arisen as to the exact species which produces it. The root of this species,—which is a native of the South American main, as well as of the West-Indian islands, and is known on the continent by the name of Parreyra-brava (Wild vine, *Portug.*) and on the islands by that of Velvet-leaf,—has been long used in both situations as a bitter tonic and diuretic. But according to Auguste St Hilaire, a different species, the *C. glaberrima*, furnishes the true root, or Red Pareira, of Brazil,—the country whence the remedy was first introduced into Europe. And Aublet, referring a variety of the drug, distinguished by the name of White Pareira, to the *Abuta subrufescens*, another plant of the same family, adds that the Red Pareira is obtained from a variety of this species. All these plants are climbers, belonging to the Natural Family *Menispermaceæ*, and to Linnæus's class and order *Diœcia Monadelphia.*

Chemical History.—The root is imported in roundish pieces, from half an inch to four inches in diameter, from four inches to four feet in length, and often split longitudinally. These consist of a thin, grayish-brown, firmly-adhering epidermis, somewhat wrinkled, covered transversely by annular elevations, and spotted, especially the larger pieces, with knotty excrescences,—and of a reddish woody interior composed of concentric rings, very porous, and easily split. It is without odour, but has an intensely bitter, somewhat aromatic taste, preceded by sweetness. It readily imparts its taste and active properties to water; and through means of this menstruum are obtained the officinal *Infusum* and *Extractum pareiræ.* The decoction, preferred by some, has no real advantage over the infusion. A better preparation than either would be a solution obtained with cold water by percolation, as in the Edinburgh formula for obtaining the extract; because the product, as it does not contain the starch of the root, is less apt to decay. The chemical composition of the root has been successfully examined by Wiggers, who ascertained, that the active part is an alkaloidal uncrystallizable principle, insoluble in water, soluble in ether

alcohol, and acids, and of an intense sweetish bitterness. It has been named Cissampelina or Pelosa.

Actions and Uses.—Pareira-root is considered to be a tonic, diuretic and aperient, and likewise to possess specific virtues over various disorders of the urinary organs, more especially chronic inflammation of the bladder. A careful inquiry into its physiological actions is much wanted; for some have failed to observe the diuretic and aperient properties ascribed to it by others; and they are disposed to think, as would be anticipated alike from its sensible qualities and its place in the natural arrangement of vegetables, that it is nothing else than an excellent tonic bitter, akin to calumba. The authority of Sir B. Brodie, who recommended it in chronic urinary diseases, and especially in chronic inflammation of the urinary bladder, brought it into general employment. The information communicated to me on this point by various surgeons here who have made trial of it is not in its favour. When first used currently in Europe at the close of the seventeenth century, it was thought capable of curing stone in the bladder.

The doses of its preparations are: *Infusum pareiræ* E. L. fl.unc. i. ad fl.unc. iv.—*Extractum pareiræ*, E. L. gr. x. ad scr. i.

PASTINACA OPOPONAX. See *Opoponax*.

PETROLEUM, *E.* PETROLEUM BARBADENSE, *L. D.*
Petroleum; Rock-oil; Barbados-tar, L. D.

For. Names.—*Fren* Pétrole.—*Ital.* Petrolio.—*Span.* Petroleo; Aceyte mineral.—*Port.* Petroleo.—*Ger.* Steinöl; Bergöl.—*Swed.* Bergolja.—*Dan.* Steenolie; Peterolie.—*Arab.* Neft.—*Tam.* Mun tylum.—*Beng.* Muttie ka tel.

Although this old remedy is retained in the British Pharmacopœias, it is all but abandoned in practice. Indeed I question whether it is used by a single practitioner in this part of the kingdom; and scarcely any druggist keeps it. It is a natural production, being met with as a mineral in various parts of the world. Several forms of bitumen occur in the mineral kingdom, such as asphalt, which is always hard and brittle,—mineral pitch, which is brittle in cold weather, but soft and pliant at a moderate heat,—mineral tar, which is viscid at all ordinary temperatures,—petroleum, which is a thick fluid at ordinary temperatures,—and naphtha, a yellowish etherial, very mobile, and very light liquid.

Natural History.—Petroleum, the only officinal species, is found floating on the water of some springs in this country. In Barbados it is produced in the same way in considerable quantities. At Trinidad it forms great beds or lakes. Near Rangoon it may be obtained to an indefinite extent on digging into the soil in the warm season. The London and Dublin Colleges have restricted the source of supply unnecessarily to Barbados. Whatever proper-

ties petroleum may possess, they will be found probably in greater force in that of Rangoon than in any other sort.

Chemical History.—It differs much in characters and composition as produced in different places. That of Barbados and Trinidad has a dusky greenish-brown colour, a peculiar, not agreeable, bituminous odour, and the consistence of very thick cream or treacle. Under exposure to the air it gradually hardens to the consistence of pitch. Heat increases its liquidity, but does not render it a thoroughly mobile fluid; and a higher heat expels a naphthous liquid, whose properties have not been carefully examined. Acids, alkalis, and rectified-spirit have little effect on it. Ether becomes green when shaken with it; and the oils, fixed, as well as volatile, dissolve it. It consists chiefly of carbon and hydrogen, with a little oxygen and nitrogen. The petroleum of Rangoon has also a dark greenish-brown colour, a strong, rather fragrant odour, and the consistence of lard in warm weather. When heated to 90° it becomes a very mobile liquid. Acids, alkalis, and rectified-spirit, ether, fixed oils and the volatile oils, act as upon the other variety. Heat expels a naphthous fluid in great quantity and afterwards a crystalline principle. The latter I discovered to be paraffin; and indeed the properties of this principle, as derived from Rangoon petroleum, were ascertained before the discovery of it in tar by Reichenbach was known in this country. In the naphthous fluid, which closely resembles native Persian naphtha, Dr Gregory afterwards discovered eupion, another of Reichenbach's products of destructive distillation. It appears then that Rangoon petroleum is the product of the destructive distillation of vegetable matters; while in all probability most other varieties have not been subjected to this process.

Actions and Uses.—Petroleum has at different times been recommended as a remedy for various diseases, especially as a vermifuge, as an application for diseases of the skin, and as a liniment for rheumatism. So recently as 1808 Lucas, a German physician, recommended it both inwardly in the form of emulsion, and externally in the way of friction over the abdomen, as an effectual means of curing tapeworm (Mérat). It is probably as good an application for lepra, psoriasis and other scaly diseases as tar; whose virtues are undeniable. In the East-Indies the Rangoon petroleum, for some time after the Burmese war, came into considerable repute as a liniment for all forms of neuralgia. Those varieties which, like the Rangoon petroleum, abound in naphtha, are probably narcotic poisons in large doses.

PIMENTA, *E. L. D.* *Unripe berries of Eugenia Pimenta. DC. (Edin.) of Myrtus Pimenta, L. W. (Lond. Dub.) Pimento.*

AQUA PIMENTÆ.

PROCESS, *Edin. Lond.* Take of Pimento, bruised, a pound (or Pimento-

oil, two drachms, (L.)
Water, two gallons;
Rectified-spirit three (Proof-spirit, seven, (L.) fluidounces.
Mix them and distil off one gallon.

PROCESS, *Dub.* Take of
Pimento, half a pound;
Water, enough to prevent empyreuma.
Macerate for twenty-four hours and distil off a gallon.

OLEUM PIMENTÆ.

PROCESS. To be prepared according to the general directions for distilling Volatile oils. See *Introduction.*

SPIRITUS PIMENTÆ.

PROCESS, *Edin.* Take of
Pimento, bruised, half a pound.
Proceed as for *Spiritus carui.*

PROCESS, *Lond.* To be prepared like *Spiritus Myristicæ.*

PROCESS, *Dub.* Take of
Pimento, bruised, three ounces;
Proof-spirit, one gallon;
Water, enough for preventing empyreuma.
Macerate for twenty-four hours and distil off a gallon.

FOR. NAMES. *Fren.* Piment; Poivre de la Jamaïque.—*Ital.* Pepe d'India.—*Port.* Pimenta da Jamaica.—*Ger.* Nelken-pfeffer; Englisch gewürz.—*Dut.* Jamaica-peper.—*Swed.* Krydd-peppar.

FIGURES of Eugenia Pimenta as Myrtus Pimenta in Nees von E. 298.—Hayne, x. 37.—Sloane's Jamaica, ii. t. 191.—Eng. Bot 1236.—Steph. and Ch. ii. 124.

PIMENTO, ALL-SPICE, or JAMAICA-PEPPER, has been known in Europe for at least two centuries.

Natural History.—It is produced by the *Eugenia Pimenta* of Decandolle and Lindley, or *Myrtus Pimenta* of other botanists, a native of the West-Indies and of Mexico. It belongs to the Linnæan class and order *Icosandria Monogynia*, and to the Natural family *Myrtaceæ* of Lindley, or *Myrtineæ* of Decandolle. It is a beautiful tree towards thirty feet in height. It flowers from June to August, and bears berries about the size of a small pea. These when ripe are viscous on the outside, and possess little aroma; but if gathered while green and not quite ripe, they are, like most parts of the tree, powerfully aromatic. When dried, they are brownish-black, round, rough, and crowned with the teeth of the calyx. They consist of a rind, which is yellowish internally, enveloping two dark-brown seeds. They have a strong aromatic odour, and a hot aromatic taste, combining that of cinnamon, nutmeg, and cloves,—whence is derived one of their vernacular names, All-spice. The taste and odour are stronger in the rind of the berry than in the seed.

Chemical History.—The aroma is readily communicated to water, alcohol, or proof-spirit, and passes over in distillation with any of these fluids, constituting the *Aqua* and *Spiritus pimentæ.* This aroma depends on an acrid volatile oil, which may be obtained from the berries by distillation with water in a proportion varying from a fiftieth (Braconnot) to a sixteenth (Hagen). The oil, the *Oleum pimentæ* of the Pharmacopœias, somewhat resembles oil of cloves, which is derived from a different plant of the same natural family. It is reddened by nitric acid. It consists of two oily principles,—one lighter than water, a pure, neutral hydro-carbon,—and the

other heavier than water, and capable of uniting with alkalis (Pereira). Hence they may be separated by distilling the oil with solution of potash. The light oil passes over; while the other, which remains behind, may be detached from the potash by sulphuric acid. Bonastre found the rind of pimento-berries to consist of 10 per cent of volatile oil, 8 green fixed oil, 1.2 resin, 11.4 astringent extract, and 50 lignin, with some gum, sugar, colouring matter, and various salts; and the seeds are similarly composed, but contain only half the proportion of volatile oil, and three times as much astringent extract. Very different results however have been obtained by Braconnot; who says the entire fruit consists of 2 per cent of volatile oil, 1 reddish wax, 6 gum, 9 starch, 5 azotized matter, 6 citrate of potash, 3.4 calcareous salts, and 67.8 lignin.

Adulterations.—Pimento is said by some German authors to be occasionally adulterated with the berries of Cocculus-indicus, to which it bears some distant resemblance. The adulteration is known by the absence of the persistent calyx, and the intense bitterness of the seed, without any aroma.

Actions and Uses.—Pimento is a good deal used as a hot aromatic in cookery, but very little in medicine. It possesses the stimulant, stomachic, and carminative properties of the hot aromatics generally. It enters into the composition of the London and Dublin *Syrupus rhamni*, the griping tendency of which is diminished by this addition.

The doses of its preparations are; *Pulvis pimentæ*, gr. x. ad gr. xxx. *Aqua pimentæ*, fl.unc. i. ad fl.unc. iv. *Spiritus pimentæ*, fl.dr. i. ad fl.dr. ii. *Oleum pimentæ*, min. ii. ad min. v.

PIMPINELLA ANISUM, *D.* See *Anisum.*

PINUS ABIES, &c. *D.* See *Terebinthina.*

PIPER CUBEBA, *L. D.* See *Cubeba.*

PIPER LONGUM, *E. D.* *Dried spikes* (*Seeds, D.*) *of Piper longum, L. W. Spr.* *Long Pepper.*

For. Names.—*Fren.* Poivre long.—*Ital.* Pepe lungo.—*Span.* Pimienta lunga.—*Port.* Pimenta longa.—*Ger.* Langer pfeffer.—*Dut.* Lange peper.—*Swe.* Lang peppar.—*Russ.* Perets dlinnoi.—*Arab.* Dar filfil.—*Pers.* Filfili daraz.—*Tam.* Tipilie.—*Beng.* Pipili.—*Hind.* Pipel.

Figures of Piper longum in Nees von E. 23.—Van Reede, vii. 14.—Steph. and Ch. iv. 174.

Long-pepper has been usually referred to the *Piper longum*, a creeper belonging to the Linnæan class and order *Diandria Trigynia*, and to the Natural family *Piperaceæ*, which grows naturally in bushy places in the Circars on the Indian continent, and is also extensively cultivated in Bengal. But Miquel, subdividing the extensive genus *Piper*, refers it to three species of his new genus

Chavica, the *C. officinarum*, which yields the long-pepper of the Philippines, and *C. pepuloides* and *C. Roxburghii*, the sources of the article from the Indian continent. Long pepper consists of long, somewhat cylindrical bodies, from an inch to an inch and a-half in length, and about two lines in thickness, grayish-brown in colour, and covered with little eminences in spiral rows, containing each a seed of the size of a small pin's head. These cylinders are composed of numerous little berries closely united to one another. They have an aromatic odour, and an intense fiery taste like that of black-pepper. Their chemical composition, according to the analysis of Dulong, is nearly the same with that of black-pepper, as described under that article.

Long-pepper possesses the properties of the hot aromatics, and in this respect is identical with black-pepper, for which it is sometimes used both in cookery and in medicine. It is however a needless addition to the Pharmacopœias.

PIPER NIGRUM, *E. L. D.* *Dried (unripe, E.) berries (seeds, D.) of Piper nigrum, L. W. Spr.* *Black Pepper.*

CONFECTIO PIPERIS, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take Black-pepper, and Elecampane (Liquorice-root, E.) of each one pound; Fennel, three pounds; Honey, and White sugar, of each two pounds. Triturate the solids together into a very fine powder, and beat the whole into a uniform mass.

UNGUENTUM PIPERIS, D.

PROCESS, *Dub.* Take of Prepared axunge, a pound: Black-pepper, in powder, four pounds. Make them into an ointment.

FOR. NAMES.—*Fren.* Poivre; Poivre noir.—*Ital.* Pepe.—*Span.* Pimienta nera. —*Port.* Pimenta negra.—*Ger.* Schwarzer pfeffer.—*Dut.* Gemeene peper.—*Swed.* Swarteller starkpeppar.—*Dan.* Sort peber.—*Russ.* Perets tschernoi.—*Arab.* Tilfil uswud.—*Pers.* Tilfil-seeah.—*Tam.* Mellaghoo.—*Hind.* Meerch. —*Beng.* Kali mirchaï.

FIGURES of Piper nigrum in Nees von E. 21.—Bot. Mag. 3139.—Roque, 176.—Hort. Mal. vii. 12.—Steph. and Ch. iv. 174.

BLACK-PEPPER is the Πεπερι of Dioscorides and other Greek physicians, who probably derived their knowledge of its properties from India, its native country.

Natural History.—It is produced by the *Piper nigrum*, a plant of Linnæus's class and order *Diandria Trigynia*, and of the Natural family *Piperaceæ.* It is a native of the East-Indian continent, as well as of many islands in the Indian Ocean; and it is extensively cultivated in various parts of the East and West Indies. The plant is a climber or trailer, which, like the ivy, strikes root as it spreads, and clings to adjoining objects. The fruit is produced in the form of sessile berries closely set on slender spikes from three to six inches long. These ripen in irregular succession

throughout the whole year, becoming first green, then red, and finally black. Black-pepper is the entire berry collected and dried in its red state, when not quite ripe; and it consists of a shrivelled pulp enveloping a single seed. When allowed to ripen, and then divested of its husk, it constitutes the White pepper of the shops. Black-pepper is imported chiefly from the East-Indian islands, and especially from Sumatra. The imports amount to above two millions of pounds annually (Pereira).

Chemical History.—It is of the size of a small pea, roundish, but somewhat wrinkled, dark brownish-black externally, and composed of a dark tegument covering a grayish-yellow globular seed. It has a peculiar aromatic odour, and a fiery, bitterish taste. It imparts its acrimony readily to water, but still more readily to alcohol or proof-spirit. White-pepper has the same taste and odour but in a milder degree. These peppers have been analyzed by Oersted, by Pelletier, and by Lucae. They consist of an acrid resin, a little bland volatile oil, and a neutral crystalline principle called Piperin, together with some starch, bassorin, arabin, extractive matter, malic and tartaric acids, various salts and lignin. Their active properties reside chiefly in the resin and piperin. The resin is soft, most intensely acrid, soluble in alcohol and ether, and much more abundant in black than in white pepper. Piperin, when quite pure, which it is rendered with difficulty, forms colourless rhombic prisms, insoluble in water, soluble in alcohol, ether, or acetic acid, fusible at 212°, neutral, and capable of producing red solutions with nitric and sulphuric acids. It is said to be bland when quite pure; but the whitest crystals I have been able to obtain were as acrid as those which were brownish, and they emitted an intensely irritating vapour when thrown on a heated iron plate. It exists both in black and white pepper; but most abundantly in the latter. It is best obtained by exhausting ground white-pepper with cold rectified spirit by percolation, distilling off most of the spirit, and purifying the crystals which slowly form in the residuum by repeatedly crystallizing them from rectified spirit or pyroligneous acid. It is said to consist of thirty-four equivalents of carbon, nineteen of hydrogen, six of oxygen and one of nitrogen,—$C^{34}H^{19}O^{6}N$ (Liebig).

Actions and Uses.—Black pepper is the most familiar of the hot aromatic condiments. It is a tonic, stimulant, carminative, and febrifuge. It is in universal use as a stomachic. It is not much employed in medicine except for correcting the tendency of other drugs to excite nausea. It forms an important part of the *Confectio piperis*, an imitation of Ward's paste, which has been for some time an approved nostrum in hæmorrhoids. Black pepper is one of the many hot aromatics which have been held to possess the property of arresting ague. In very large doses it is probably an irritant poison.

The doses of its officinal preparations are: *Confectio piperis*, dr. ss. ad dr. i.—*Pulvis piperis*, gr. v. ad gr. x.

PISTACIA LENTISCUS, *D.* See *Mastiche.*

PISTACIA TEREBINTHUS, *D.* See *Terebinthina Chia.*

PIX. See *Terebinthina.*

PLUMBUM. *Lead.*

FOR. NAMES.—*Fren.* Plomb.—*Ital.* Piombo.—*Span.* Plomo.—*Port.* Chumbo.—*Ger.* Bley.—*Dut.* Lood.—*Swed.* Bly.—*Dan.* Blye.—*Russ.* Svinets.—*Arab.* Anuk.—*Pers.* Surb.—*Tam.* Eeum.—*Hind.* Sisa.—*Beng.* Sheesh.

ALTHOUGH LEAD in the state of metal is not now employed in any of the British Pharmacopœias, its chemical, medicinal, and toxicological relations are so important, that a few observations on the subject will not be out of place here.

Natural History.—Lead appears to have been known from a very early period. It occurs rarely native, but abundantly throughout most parts of the globe in the form of sulphuret, carbonate, sulphate, and phosphate. It is chiefly obtained from the sulphuret, or galena, and from the carbonate, or white lead,—from the latter, by reduction with carbonaceous matter, to which lime is often added, —from the former, by roasting it in a reverberatory furnace, with certain additions and precautions which it is unnecessary to detail.

Chemical History.—Lead has a bluish-gray colour, with great brilliancy on a fresh surface. It is so soft as to take the impression of the nail, and to be easily cut with a knife. It bends easily, and is moderately malleable, but not so ductile. Its density is 11.38. It fuses about 612°, and may be crystallized from a state of fusion in octaëdres. It has not yet been sublimed. It is soon tarnished under exposure to the air, and a thin whitish crust gradually forms over its surface. The same change takes place much more quickly when the lead is placed under distilled water; and at the same time minute foliaceous crystals of a white colour, and brilliant pearly lustre are abundantly formed. The chemical action here consists in the lead combining with oxygen and water to form hydrated oxide of lead, and then with the carbonic acid of the atmosphere to form a carbonate of lead, which consists of two equivalents of neutral carbonate and one of hydrated oxide. The action is impeded by the coexistence of any neutral salts in the water; and some salts whose acids form very insoluble compounds with oxide of lead prevent the action entirely in very minute proportion. Lead unites with oxygen in no less than four proportions, forming a gray or dinoxide, a yellow or protoxide, a brown binoxide which has acid properties, and a red oxide which is a compound of the protoxide with the binoxide. The second and fourth of these are officinal. It also unites with sulphur to constitute the ore galena or lead-glance, from which most of the lead of this country is obtained. It unites

likewise with chlorine to form a crystalline chloride. Its protoxide combines readily with the acids, forming salts which are generally colourless and crystallizable, and which differ greatly in solubility. All its compounds which are somewhat soluble present the singular combination of astringency and sweetness; and some of them, such as the acidulous citrate, possess the latter property in considerable purity. Of its saline compounds the acetate, diacetate, carbonate, nitrate, chloride, and iodide, together with a mixture of various fatty salts, constituting litharge-plaster, are more or less used in medicine or pharmacy.

Adulterations.—The lead of commerce always contains a trifling admixture of other metals, especially iron and copper. Iron and copper may be detected by dissolving the lead in diluted nitric acid, precipitating the lead with a slight excess of sulphuric acid, and then adding ammonia to the filtered solution; upon which the fluid becomes violet if copper be present, and yields a yellow precipitate if iron also coexist.

Actions and Uses.—The Medicinal Actions of lead will be most conveniently treated of under the head of its principal preparation, the acetate. In the present place it may be well to notice its peculiar properties as a poison. Few substances possess so singular an action as lead upon the body. When it is introduced into the animal system in small but often repeated doses for a series of months, it produces a constitutional state so peculiar as to be aptly called Plumbism, in the same manner as iodism and mercurialism are spoken of among the effects of iodine and of mercury. It thus induces in the first instance severe dyspepsia, with obstinate constipation and gloominess of mind; and if these warnings be neglected, there ensues a peculiar variety of colic, distinguished by the violence of the fits, their duration, and their obstinate tendency to recur. From this state some recover under proper treatment without any farther symptoms. But others are seized sooner or later either with symptoms like those of apoplexy, which prove fatal, or with a singular sort of palsy affecting all the muscles more or less, but especially those of the arms, and above all the balls of the thumbs and extensors of the fingers. The paralytic affection is commonly incomplete, always very obstinate, yet for the most part curable under tonic treatment, graduated exercise, attention to the bowels, and avoidance of fresh exposure to the cause of the disease. It is usually accompanied with dyspepsia, tendency to constipation and colic, great lassitude, restlessness, anxiety and gloominess of spirits. A peculiar symptom said to attend almost invariably the constitutional action of lead, is a blue line upon the gums, where they touch the teeth (Burton). Lead-colic or Colica pictonum, and lead-palsy, may be occasioned by handling any of the preparations of lead or breathing their dust. An attempt has been made by Dr A. T. Thomson to show, that no preparation possesses this pro-

perty except the carbonate; but doubts may be entertained of the accuracy of that conclusion. The risks which workmen encounter, who are constantly in contact with lead and its compounds, may be in a great measure averted by scrupulous attention to cleanliness, and by proper contrivances to prevent dust and maintain ventilation in their workshops. When a tendency to lead-colic or palsy has once shown itself, the only effectual corrective is abandonment of the occupation which is the source of exposure.

Lead is chiefly used in Pharmacy for making the nitrate, and also for fabricating various pharmaceutic utensils. In regard to the latter application of it, care should be taken not to preserve distilled-water, rain, snow-water, or the distilled waters of plants in contact with lead, otherwise carbonate of lead forms in abundance, and the water also contains a trace of lead in solution. Neither ought ordinary terrestrial waters to be kept very long in leaden vessels, because the same changes, though not appreciable in a few days or weeks, are nevertheless accomplished in the course of time. Acidulous fluids also, such as fluids containing the vegetable acids, ought not to be kept in contact with lead, since the lead gradually becomes oxidated at the expense of the oxygen in the atmosphere, and is then dissolved.——Sheet-lead has been employed as an application for indolent ulcers. Its alleged good effects are probably owing to the protection and support which it supplies; but may also depend, as some imagine, upon the astringent action of the carbonate of lead formed on its surface.

PLUMBI ACETAS, *E. L. D.* *Acetate of Lead.*

TESTS, *Edin.* Entirely soluble in distilled water acidulated with acetic acid: Forty-eight grains thus dissolved are not entirely precipitated by a solution of thirty grains of phosphate of soda.

TESTS, *Lond.* Soluble in distilled water. In this solution carbonate of soda occasions a white, iodide of potassium a yellow, and sulphuretted-hydrogen a black, precipitate. Sulphuric acid evolves acetous vapours; and heat first fuses and then reduces it.

PROCESS, *Edin. Lond.* Take of
Pyroligneous acid of the density 1034, two pints (acetic acid, four pints, L.);
Distilled-water, one pint (four, L.);
Litharge, fourteen ounces (four pounds and two ounces in powder, L.).
Mix the acid and water, add the litharge, dissolve it with the aid of a gentle heat, filter, and concentrate the solution sufficiently for crystallization on cooling.

PROCESS, *Dub.* Take any quantity of Carbonate of lead, and ten times its weight of distilled vinegar. Digest them in a glass vessel till the vinegar become sweet. Pour off the liquor, add more vinegar, and proceed as before. Filter the liquors and crystallize the salt by alternate slow evaporation and cooling. Dry the crystals in the shade.

PILULAE PLUMBI OPIATAE, E.

PROCESS, *Edin.* Take of
Acetate of lead, six parts;
Opium, one part;
Conserve of red roses, about one part.

Beat them into a proper mass, which is to be divided into four grain pills.—This pill may be made also with twice the quantity of opium.

UNGUENTUM (CERATUM, L.) PLUMBI ACETATIS, E. L. D.

PROCESS, *Lond.* Take of
Powder of acetate of lead, two drachms;
White-wax, two ounces;
Olive-oil, eight fluidounces.
Dissolve the wax in seven fluidounces of the oil, add gradually the acetate previously triturated with the rest of the oil, and stir the mixture as it concretes.

PROCESS, *Edin.* Take of
Simple ointment, 20 ounces (see *Olivæ Oleum*);
Acetate of lead in fine powder, 1 ounce.
Mix them thoroughly.

PROCESS, *Dub.* Take of
Ointment of white-wax, a pound and a half;
Acetate of lead, an ounce.
Make an ointment.

FOR. NAMES.—*Fren.* Acetate de plomb; Extrait de Saturne.—*Ital.* Acetato di piombo; Zucchero di Saturno.—*Ger.* Einfach essigsaures bleioxyd; Bleizucker. —*Russ.* Uksusnokisloi svinets.

ACETATE OF LEAD (Sugar of lead; Superacetate of lead; *Saccharum saturni*) has been known at all events so early as in the time of Basil Valentine in the fifteenth century. It is an artificial production, and is prepared on the great scale by the manufacturing chemist for a variety of purposes in the arts, in many of which it is extensively used. On this account, and because it may be readily obtained of good quality, the Colleges might dispense with a process for making it.

Chemical History.—The process of the Dublin College is unnecessarily costly, in so far as it requires an expensive preparation both of acetic acid and of lead; white-lead besides is much subject to adulteration; and the weakness of the acid involves much trouble in concentrating the solution. The process of the two other Colleges, which consist in simply dissolving the protoxide of lead in diluted pyroligneous acid, is considered to be one of the methods followed by British manufacturers. For the success of the process it is desirable that the pyroligneous acid be colourless. Should the acid be faulty in that respect, and the crystallized salt be consequently also discoloured, it may be purified by fusing it quickly but cautiously, dissolving it with a slight excess of acetic acid, and crystallizing it anew (Geiger). Another but more tedious process a good deal practised on the large scale, consists in hanging lead-plates in distilled vinegar or diluted pyroligneous acid so that one-half of the plates shall be immersed while the other is exposed to the air, and turning them from time to time as the upper halves become covered with oxide. A saturated solution is at length obtained, which is crystallized by evaporation and cooling. This result is obtained more speedily by sprinkling weak acetic acid over coarsely granulated lead contained in covered vessels, upon which oxide of lead is immediately formed, with the disengagement of heat,—then dissolving out the oxide by means of more diluted acid, which is saturated by passing it through several vessels in succession,—and repeating the sprinkling and solution alternately till the lead is consumed (Geiger). Whatever method be followed, it is always necessary that a slight excess of acid be present, in order to obtain a perfect and easy crystallization.

The acetate of lead of the shops has usually the appearance of a confused white mass of interlaced needly crystals, possessing an

acetous odour, and a powerful sweet astringent taste. It crystallizes in transparent, colourless right-rhombic prisms,—terminated at each extremity by two converging planes placed upon the acute angled edges,—or truncated on two edges so as to form six-sided prisms. It effloresces slightly in the air, parting at the same time with a little of its acid. In the air-pump vacuum, and with the aid of sulphuric acid or quicklime to absorb water as it escapes, the acetate of lead falls into a white powder, which is completely anhydrous. The crystallized acetate when heated fuses in its water of crystallization: at a heat of 320° its whole water, with a small proportion of its acid, is speedily discharged, and a heavy white opaque mass remains: a higher heat fuses it again, decomposes it, and disengages acetic acid and acetone or pyro-acetic spirit: and as the temperature rises farther a brownish-black mass is formed, which, when urged with a stronger heat, yields globules of metallic lead. It is soluble both in water and in rectified spirit. Temperate water dissolves from a fourth to three-fifths of its weight, according to different authorities. There is always some muddiness produced when it is dissolved, because the carbonic acid in the water unites with a little excess of oxide of lead commonly contained in the acetate; or combination takes place between the oxide and a trace of organic matter, which almost all waters present more or less in solution. The muddiness is removed by a few drops of acetic acid. The solution faintly reddens litmus, but rather turns syrup of violets green. It is precipitated black by sulphuretted hydrogen, yellow by iodide of potassium, yellow by bichromate of potash, white by the alkalis, white by their carbonates and sulphates,—the respective precipitates being sulphuret, iodide, chromate, hydrated oxide, carbonate, and sulphate of lead. A plate of zinc slowly separates the lead in the form of beautiful arborescent foliaceous crystals, and the zinc takes the place of the lead in the solution. The best mode of detecting lead in a state of complex mixture in organic substances is to heat the substance with water containing some nitric acid, to treat the filtered solution with sulphuretted-hydrogen, and to reduce the sulphuret on charcoal with the blowpipe. If no dark precipitate be occasioned by sulphuretted hydrogen, lead may still be sought for in the residue left on the filter by drying and incinerating it, heating the ashes with nitric acid, neutralizing the nitric acid, and testing the solution with any of the liquid tests mentioned above. Acetate of lead consists of one equivalent of protoxide of lead, one equivalent of acetic acid, and three equivalents of water of crystallization, ($C^4H^3O^3 + PbO + 3HO$ or $\bar{A} + PbO + 3Aq$), and consequently of 51.48 parts of acid, 111.6 of base, and 27 of water.

Adulterations.—Acetate of lead is little subject to contain impurities. Copper is said to occur occasionally; but this would be too palpable an adulteration, in consequence of the bluish colour which is caused by even a slight admixture of that metal. The

tests given by the London College are not of a kind to detect adulterations, but will merely determine the nature of the salt. The reactions of the tests must be obvious from what has been stated above of the properties of the dissolved acetate. The characters given by the Edinburgh College are entire solubility, and the property of decomposing a certain proportion of crystallized phosphate of soda. Complete solubility is a test which no specimen will absolutely withstand, for reasons already given; but if the salt and water be pure, a mere haze only is produced. Thirty grains of phosphate of soda and 47.66 of acetate of lead exactly decompose one another. Hence if 48 grains or a 140th part more of the latter salt be used, the solution will be affected after filtration by a farther addition of phosphate, provided the acetate be tolerably pure. The ordinary impurities contained in the acetate either do not decompose phosphate of soda at all, or decompose so much less a proportion than acetate of lead, that it is plain their presence in any material quantity would leave in the solution a large excess, not of the salt of lead, but of the phosphate of soda; and consequently the farther addition of the test to the filtered fluid will have no effect. A hundredth part of impurity may easily be thus detected.

Actions and Uses.—The medicinal actions and uses of acetate of lead have within a few years become exceedingly important. It is in large doses an irritant, in medicinal doses an astringent and sedative; and in long-continued small doses it may induce the peculiar constitutional action of the preparations of lead. At one time it was thought to be a powerful irritant poison; but it is far from being energetic as such,—several drachms having been at times swallowed without occasioning more than severe sickness, some pain in the stomach, vomiting and violent griping,—and no fatal case having yet been recorded. Its best antidote is sulphate of soda, sulphate of magnesia or phosphate of soda, which should be followed by emetics if necessary, and then by alternate purgatives and opium. It has been doubted by some whether acetate of lead possesses the property, belonging to other preparations of the metal, of exciting colic and palsy when long administered in small quantities at a time. On the whole it seems to be established that both when given internally, and when used outwardly, it may have these effects; but that they are exceedingly rare when the salt is given for medicinal purposes under the observation of a medical man.

In medicinal doses acetate of lead is a powerful astringent both of dead and of living animal fibre. This property is exerted directly on the part to which it is applied, and indirectly on parts at a distance. Acetate of lead differs from most other astringents in producing at the same time a remarkable sedative effect upon the nervous system where it is applied. This action is well exemplified in the immediate arrestment of the vermicular movement of the in-

testines when its solution is brought in contact with them, and likewise by its marked effect in allaying pain in local inflammation. It is doubtful whether acetate of lead is generally absorbed in the course of its constitutional action as a poison, or its indirect astringent action. In animals killed by the constitutional action of the acetate I have seldom been able to detect lead anywhere throughout the body; but Wibmer says he could generally detect traces of it in the liver, lumbar muscles, and spinal chord.

The important concurrence of sedative and astringent virtues renders the acetate of lead a useful remedy for many special therapeutic purposes. Externally it is employed in most forms of superficial inflammation, in the early stage of which it is often singularly serviceable. Some would restrict its use to phlegmonous inflammation. But it may also be resorted to with safety, and often with great advantage, especially if united with opium, in erythema, spreading inflammation of the subcutaneous cellular tissue, and erysipelas. It is also beneficial in many cutaneous eruptions, attended with surrounding inflammation, or accompanied by itching or heat. It is usually applied in the form of solution by means of soft cloths, which ought never to be allowed to dry; or it may be applied on the surface of a poultice; and the solution commonly made use of consists of a drachm of the salt to five or eight ounces of distilled water or some aromatic water, with a scruple of distilled vinegar to maintain the oxide from being thrown down. For erythema and erysipelas, its best form and one of the best of applications, is a lotion consisting of four grains each of acetate of lead and of opium to every ounce of water. Decomposition takes place when these substances are mixed,—acetate of morphia remaining in solution and meconate of lead falling down insoluble; but the proportions here given leave an excess of acetate of lead in the lotion. In the case of cutaneous eruptions the form of ointment is usually preferred; for which the Pharmacopœias have a formula. This salt is now much used internally as a sedative astringent for diarrhœa and dysentery, pulmonary catarrh, and hæmorrhagies. It first came into general use as a remedy for the different kinds of hæmorrhagy. In hæmoptysis, hæmatemesis, hæmorrhoïs, hæmaturia and menorrhagia it is often serviceable; in all of which diseases it must obviously act as a constitutional, not as a topical, astringent. It is chiefly useful in the passive, yet is not contraindicated in the active, forms of hæmorrhagy. In pulmonary catarrh it has been employed both in the acute and chronic forms; and it is undoubtedly sometimes beneficial in lessening and inspissating the expectoration. In dysentery and diarrhœa, its employment has of late been greatly extended. It has been chiefly employed in chronic cases, whether idiopathic, or secondary to other diseases, such as phthisis pulmonalis. For these affections there is no remedy yet known which equals in efficacy the *Pilulæ plumbi opiatæ* of the Edinburgh Pharmacopœia, each of which contains three

grains of acetate of lead and half a grain of opium, and of which from two to six may be given in the course of the day, according to the urgency of the symptoms. There is no danger of constitutional effects from the long-continued use even of the largest of these doses, so long as the evacuations from the bowels are not materially diminished. I have given acetate of lead to the extent of six grains on an average daily for several months in phthisis, without any palsy, colic, or dyspepsia being induced, and with good effect in retarding the progress of the affection of the bowels. In severe cases of obstinate dysentery, advantage is also found in the occasional administration of an injection of ten or fifteen grains of acetate of lead in four fluidounces of water.

The doses of acetate of lead and its preparations are as follows; *Acetas plumbi*, E. L. D. gr. ii. ad gr. vi. bis terve indies. *Pilulæ plumbi opiatæ*, E. i. ad ii. bis vel ter indies. *Unguentum acetatis plumbi*, E. D. *Ceratum acetatis plumbi*, L. externally.

PLUMBI CARBONAS, *E. L. D.* *Carbonate of lead. Carbonate of protoxide of lead.*

TESTS, *Edin.* It does not lose weight at a temperature of 212°; Sixty-eight grains are entirely dissolved in 150 minims of acetic acid diluted with a fluidounce of distilled water; and the solution is not entirely precipitated by a solution of 60 grains of phosphate of soda.

TESTS, *Lond.* Diluted nitric acid dissolves it with effervescence: Potash causes in this solution a white precipitate, and in excess redissolves it: Hydrosulphuric acid blackens it. Heat alone renders it yellow; but, along with charcoal, reduces it to the metallic state.

UNGUENTUM PLUMBI CARBONATIS, E. D.

PROCESS, *Edin.* Take of
Simple ointment, five ounces;
Carbonate of lead, one ounce;
Mix them thoroughly together.

PROCESS, *Dub.* Take of
Carbonate of lead, in very fine powder, two ounces;
Ointment of white wax, a pound.
Make an ointment.

FOR. NAMES.—*Fren.* Carbonate de plomb; Cérusse.—*Ital.* Carbonato di piombo; Cerussa; Biacca.—*Span.* Albayale fino.—*Ger.* Kohlensaures bleioxyd; Bleiweiss.—*Dut.* Loodwit; Cerus.—*Swed.* Blyhwiit.—*Dan.* Bleghvidt.—*Russ.* Uglikisloi svinets; Svintsovya belila.—*Arab.* Asfidaj.—*Pers.* Suffiah.—*Tam.* Vullay.

CARBONATE OF LEAD (Cerusse, white-lead) was known to the Greeks under the name of Ψιμύθιον, and to the Romans by that of *Cerussa*, as obtained both by the exposure of lead to the air, and by one of the artificial processes still followed in modern times. It occurs in nature, and frequently crystallized in white, brilliant, prisms; but that which is used in medicine and the arts is all obtained from the chemical manufacturer.

Chemical History.—As it is prepared by the manufacturer on the large scale, the Colleges have not given a process for it. Various methods are followed. The most recent process consists in

mixing litharge with a hundredth part of acetate of lead, making this into a paste with water and transmitting carbonic acid gas. A fine amorphous and opaque white lead is thus obtained. An old way, still sometimes practised, consists in subjecting sheet-lead to the fumes of pyroligneous acid. The acid is placed in the bottom of earthen vessels, and the lead rolled spirally is fixed a little above the acid. The vessels thus prepared are surrounded with a mixture of dung and tanner's refuse, by the heat of which the acetic acid is slowly volatilized. As its vapours rise, the lead is gradually attacked, and a considerable thickness of it converted into carbonate, which after some weeks is detached, partly by beating the sheets of lead, partly by rolling them between cylinders under water. The acetic acid is not decomposed in this process so as to yield both oxygen and carbonic acid to the lead, as has been supposed, but merely acts by forming some acetate which serves as a medium for absorbing carbonic acid (Pelouze, Hochstetter). Another method proposed by Thenard, and now adopted in France and Sweden, is to transmit carbonic acid through the solution of diacetate of lead,—by which means the excess of oxide is detached as carbonate, and neutral acetate is left in solution; and the same solution is used over and over again, by boiling it with litharge to restore the lead to the state of diacetate. In this way a very fine and pure carbonate is easily prepared either on the great or small scale. Lastly, carbonate of lead may be got slowly by exposing lead to the action of air and distilled water (see *Plumbum*); and it may be made at once, though not economically, by double decomposition from the acetate in solution, by means of carbonate of soda.

When carbonate of lead is well prepared, it is a pure white, earthy-like, friable mass, heavy, and without taste or odour. The density of its crystals in the native state is 6.25. A moderate heat drives off the carbonic acid, and the yellow protoxide is left. It is insoluble in water, but readily soluble, with effervescence, in diluted nitric and acetic acids. The solutions present the characters mentioned above under the head of the acetate of lead. The composition of carbonate of lead varies. That obtained by the action of distilled water on lead is a compound of two equivalents of neutral carbonate and one of hydrated oxide of lead ($2\ CO^2\ PbO + PbO\ Aq$). The commercial carbonate of Germany contains three equivalents of the neutral carbonate; and the composition of that of British commerce is four equivalents of carbonate and one of hydrate ($4\ CO^2\ PbO + PbO\ Aq$). A neutral carbonate is obtained by passing carbonic acid through the last kind suspended in water. The larger the proportion of hydrate in this substance, the more does its colour incline to gray.

Adulterations.—This preparation is very often adulterated; and the usual impurities are chalk and sulphate of baryta. The latter is left undissolved by diluted acetic acid. The former may be dis-

covered by throwing down the lead from the acetic solution by sulphuretted-hydrogen, and then testing the filtered liquor for lime. The Edinburgh formula is a convenient one for ascertaining whether the article be pure or not, but without indicating the nature of the impurity. Sixty-two grains of crystallized phosphate of soda almost exactly decompose 68 grains of pure commercial carbonate of lead (62.06 to 68). Hence with 60 grains of phosphate, as in the formula, some lead must remain in solution, and will be shown on adding more phosphate to the filtered liquor, but not if any material adulteration be present. The London formula, as usual, indicates chiefly the properties by which carbonate of lead may be known. Nitric acid however will leave sulphate of baryta undissolved; and potash in excess, which redissolves the hydrated oxide of lead thrown down in the nitric solution by the first portions of the alkali, will leave an insoluble white powder of lime should chalk be present.

Actions and Uses.—Carbonate of lead possesses the constitutional action proper to the compounds of that metal, as explained under the article *Plumbum.* Little is known of its medicinal effects when given inwardly, because it is never employed as an internal remedy. Externally, in the form of ointment, the only shape in which it is now used, it is an efficacious astringent for ulcers and eruptions attended with irritation.

Its only officinal preparation is the *Unguentum plumbi carbonatis*, E. D.

PLUMBI CHLORIDUM, *L.* *Chloride of Lead.*

TESTS, *Lond.* Boiling water dissolves it altogether, and on cooling deposits it almost entirely in crystals. Heat renders it yellow, sulphuretted-hydrogen black.

PROCESS, *Lond.* Take of
Acetate of lead, nineteen ounces ;
Boiling distilled water, three pints ;
Chloride of sodium, six ounces.
Dissolve the acetate in the boiling water, and the chloride in a pint of distilled water ; mix the solutions, and when the mixture has cooled, wash the precipitate and dry it.

FOR. NAMES.—*Fren.* Chlorure de plomb.—*Ital* Chloruro di piombo.—*Ger.* Chlor-blei.

CHLORIDE OF LEAD is met with in nature in the form of dense, transparent or opaque, white, prismatic crystals, and in opaque horny masses, called Horn-lead by mineralogists. It is also obtained artificially by double decomposition, as directed by the London College. A loss of nearly two-thirds of the chloride formed is said to be sustained in this process unless the fluid is evaporated down (Anthon). It is thus got in the form of a white, tasteless, crystalline, heavy powder, easily fused, and forming on cooling a translucent, horny-like mass,—whence its trite name of horn-lead. It is soluble in twenty-two parts of water at 212°, and in thirty

part at 60°; and from the former it separates in a great measure on cooling in the form of small, brilliant, tabular or acicular crystals. It is composed of one equivalent of chlorine and one of lead (Cl + Pb), and therefore of 35.42 parts of the former and 103.6 of the latter.

Chloride of lead is too little used to be exposed to adulteration. The characters given in the London Pharmacopœia are intended merely for determining its nature.

This is an unnecessary preparation, contained only in the London Pharmacopœia. It possesses in all probability the constitutional action and local astringent effects of other compounds of lead. In large doses it is an irritant poison (Taylor). But it is never used in medicine; and the only object in introducing it is for making muriate of morphia; for which object, from its sparing solubility, it is objectionable.

PLUMBI DIACETATIS SOLUTIO, *E.* PLUMBI DIACETATIS LIQUOR, *L.* PLUMBI SUBACETATIS LIQUOR, *D.* *Solution of Diacetate of Lead.—Goulard's Extract.*

TESTS *Lond.* Density 1260. Its other properties are like those of acetate of lead.

TESTS, *Edin.* A copious precipitate is gradually formed, when the breath is propelled through it by means of a tube.

PROCESS, *Edin. Lond.* Take of
Acetate of lead, six ounces and six drachms (2 pounds 3 ounces, L.);
Litharge, in fine powder, four ounces (1 pound 4 ounces, L.);
Water, a pint and a-half (6 pints, L.);
Boil the salt and litharge with the water for half an hour, stirring occasionally. When the solution is cold, add water, if necessary, to make up a pint and a half; and then filter. Preserve the solution in well-closed bottles.

PROCESS, *Dub.* Take of
Semi-vitrified oxide of lead, one part;
Distilled vinegar, twelve parts.
Boil down to eleven parts in a glass vessel; leave the solution at rest till the impurities subside, and filter it.

PLUMBI DIACET. LIQUOR DILUTUS, L. PLUMBI SUBACET. LIQUOR COMPOSITUS, D.

PROCESS, *Lond.* Take of
Solution of diacetate of lead, one fluidrachm and a-half;
Distilled water, a pint;
Proof-spirit, two fluidrachms.
Mix them.

PROCESS, *Dub.* Take of
Solution of subacetate of lead, one drachm;
Distilled water, a pint;
Proof-spirit, a drachm.
Mix them.

CERATUM PLUMBI COMPOSITUM, L.

PROCESS, *Lond.* Take of
Solution of diacetate of lead, three fluidounces;
Wax, four ounces;
Olive oil, half a pint;
Camphor, half a drachm.
Melt the wax, mix with it eight fluidounces of the oil, remove the mixture from the fire, and as it begins to concrete, add gradually the solution of diacetate of lead, and stir constantly till the mixture cools. Lastly, add the camphor dissolved in the remainder of the oil, and mix them.

FOR. NAMES.—*Fren.* Sous-acetate de plomb liquide; Extrait de Saturne.—*Ital.* Sotto-acetato di piombo; Aceto di Saturno.—*Ger.* Halb-essigsaures bleioxyd; Blei-essig; Blei-extract.

Chemical History.—Acetic acid unites with oxide of lead in several proportions besides those constituting neutral acetate of lead. One only of these compounds is officinal. It is a soluble salt, which was probably known to Basil Valentine in the fifteenth century, but was first accurately distinguished from the acetate in 1802 by Thenard. This may be obtained by evaporating the solution of the formulas in the Pharmacopœias in such a way as to prevent the free access of atmospheric air; upon which white foliaceous crystals sometimes form, but more generally an opaque, white, gummy-like, uncrystallizable mass. The officinal preparations, which are the subject of the present article, are solutions of the salt now referred to,—the DIACETATE OF LEAD. This name, which has been adopted by the Edinburgh and London Colleges, implies the constitution of one equivalent of acid and two of base; but the existence of a salt of this definite composition is doubted by some. The solution of the shops is sometimes a solution of the trisacetate, more commonly a mixture of several acetates of lead.

These solutions are all varieties of the celebrated Goulard's extract, or *Extractum Saturni*; which was first made with crude vinegar and litharge,—then with distilled vinegar, as still recommended by the Dublin College,—and now more generally, as directed in the two other Pharmacopœias, by boiling a solution of the neutral acetate with finely powdered litharge. The solution of the Pharmacopœias has an alkaline reaction upon vegetable colours. It deposites a white carbonate of lead under exposure to the air, and much more quickly when a stream of carbonic acid is transmitted into it, as by propelling the breath through a tube; and if the gas be transmitted in sufficient quantity, the water at length contains only the neutral acetate, the additional equivalent of oxide of lead being all thrown down in the shape of carbonate. Carbonate of lead is sometimes manufactured in this way (p. 708.) The other properties of the solution of diacetate of lead are much the same with those of the acetate. The *Liquor dilutus* of the London and Dublin Pharmacopœias is a convenient form for extempore use.

Actions and Uses.—The solution of diacetate of lead possesses all the actions proper to the soluble salts of this metal; but they have not yet been fully investigated. The diacetate is never used internally. It is probably the most energetic poison among the compounds of lead, and has actually proved fatal to man. It even seems to have some corrosive action, owing to an affinity existing between the animal principles and the excess of oxide it contains. It is a familiar and excellent external application in all circumstances where solutions of the acetate are used, and is preferred by some because it is not so apt to dry up and crystallize. The stronger solution of the Pharmacopœias must always be considerably diluted before being put to use.

PLUMBI EMPLASTRUM, *L.* EMPLASTRUM LITHARGYRI, *E. L.* *Litharge Plaster.* *Oleo-margarate of lead.*

PROCESS, *Edin. Lond. Dub.* Take of Litharge, in very fine powder, 5 ounces (six pounds, L., five pounds, D.); Olive-oil, twelve fluidounces (one gallon, L. D.); Water, 3 fluidounces (2 pints, L. D.); Mix them; boil (heat between 200° and 212°, D.) and stir constantly till the oil and litharge unite, replacing the water if it evaporate too far.

EMPLASTRUM LITHARGYRI CUM RESINA, D. See *Terebinthina.*

LITHARGE-PLASTER is treated of in the present place, and not as a preparation of litharge, because it is now well known to be, not a mechanical mixture, as was once thought, but a product of chemical combination, analogous in constitution to soap.

Chemical History.—Litharge-plaster (Diachylon-plaster, Common plaster, Lead-plaster) is obtained by heating together olive-oil, water and finely powdered litharge. Other oils and fatty matters will answer; but none has yet been found to yield so good a plaster as olive-oil. Union does not take place except about the temperature of 212°, which may be maintained by a slow naked fire, but is probably best secured on the large scale by steam under pressure. The water used in the process was formerly thought to serve no other purpose than to keep down the temperature and prevent charring, but it would appear that its presence is indispensable to induce the action of the litharge on the oil. The litharge ought to be very finely powdered. The water which is driven off in vapour must be replaced from time to time; and what is added must be hot, otherwise the process is retarded by refrigeration of the mixture, besides that the sudden addition of cold water may occasion spurting or explosions.—For a long time the formation of litharge-plaster was thought to depend merely on mechanical mixture of its ingredients. But since the researches of Chevreul on the composition of the oils and their saponification, it is known that the process consists of a complex set of chemical changes, by virtue of which the neutral fatty principles of the oil, being converted into fatty acids, unite with the oxide of lead, while a neutral sweet principle, glycerine, is disengaged and remains in the water. Litharge-plaster then is a mixture of various fatty salts, of which protoxide of lead is the base, and the oleic and margaric acids the chief oleaginous acids.

Litharge-plaster has a grayish-yellow colour, is very brittle, and when softened by gentle heat adheres to the skin. It is blackened by exposure to sulphuretted-hydrogen gas. When agitated with hot pyroligneous or diluted nitric acid, it is decomposed, the oxide of lead is dissolved, and the fatty acids, on the mixture being left at rest, rise to the surface like an oil, and concrete on cooling into an opaque, fibro-foliaceous mass.

Attention has not been paid to its adulterations; but it is often of inferior quality, because it will not make good resin-plaster.

Litharge-plaster has long been held to be a sovereign detersive and desiccative for indolent ulcers of various kinds. It is now little used by itself for this or any other purpose. But it is the basis of a large proportion of officinal plasters. There is no other metal whose oxides saponify olive-oil so completely as the protoxide of lead; and no oxide of lead but the protoxide will answer the purpose (Henry).

PLUMBI IODIDUM, *E. L.* *Iodide of lead.*

TESTS, *Edin.* Bright yellow: five grains are entirely soluble with the aid of ebullition in one fluidrachm of pyroligneous acid diluted with a fluidounce and a half of water; and golden crystals are abundantly deposited on cooling.

TESTS, *Lond.* Boiling water dissolves it and on cooling deposites it in shining scales. Heat melts it, and afterwards dissipates it in a great measure in vapours, which are at first yellow and then violet.

PROCESS, *Edin.* Take
Iodide of potassium and
Nitrate of lead, of each half an ounce;
Water, a pint and a half.
Dissolve the salts separately each in one-half of the water; add the solutions; collect the precipitate on a filter of linen or calico, and wash it with water. Boil the powder in three gallons of water acidulated with three fluidounces of pyroligneous acid. Let any undissolved matter subside, maintaining the temperature near the boiling point; and pour off the clear liquor, from which the iodide of lead will crystallize on cooling.

PROCESS, *Lond.* Take of
Acetate of lead, nine ounces;
Iodide of potassium, seven ounces:
Distilled water, a gallon.
Dissolve the acetate in six pints of the water and filter; add to this the iodide dissolved in two pints of water; wash the precipitate and dry it.

UNGUENTUM IODIDI PLUMBI, L.

PROCESS, *Lond.* Take of
Iodide of lead, an ounce;
Lard, eight ounces.
Mix them well together.

FOR. NAMES.—*Fren.* Iodure de plomb.—*Ital.* Ioduro di piombo.—*Ger.* Iodblei.

THE IODIDE OF LEAD has been known only since the recent discovery of iodine itself. It was introduced into the Materia Medica but a few years ago chiefly through the recommendations of Lugol.

Chemical History.—It is always obtained by double decomposition of the acetate or nitrate of lead with iodide of potassium. The nitrate is on the whole the preferable salt, as being more uniform in composition, and free of any excess of oxide of lead; for an excess interferes with the purity of the product. The London College is satisfied with directing to be preserved for use the precipitate obtained by the simple process of mutual decomposition of the two salts. But in this way a pure iodide will seldom be obtained. The reason is that the iodide is prone to form compounds with the oxide of lead. The circumstances in which this action occurs have not been all settled; but it is always apt to take place when the metal in the salt of lead is in excess to the iodine of the iodide of potassium. Hence when the acetate of lead contains an excess of oxide, which happens not unfrequently, or when the

iodide of potassium is impure, which is a more common occurrence, or when the solution of the iodide is poured into the solution of the acetate, instead of conversely,—a compound is formed of oxide and iodide of lead. If the iodide of potassium contain any of its common adulteration, carbonate of potash, carbonate of lead will also be formed in the precipitate. As it is probable that the presence of oxide or carbonate of lead may affect its medicinal actions, the process for iodide of lead should be so contrived as to avoid such impurities; and this object is attained, as in the Edinburgh process, by the additional step of crystallization from a solution in weak acetic acid, by which all the oxide and carbonate of lead are removed and retained in solution.

Iodide of lead when pure is in the form of a fine powder of an intense gamboge-yellow hue, or constitutes a loose congeries of very delicate crystalline scales of a splendid golden colour and brilliancy. It is heavy, tasteless, and inodorous. It is very sparingly soluble in water, requiring 1235 parts of cold, and 194 of boiling water. From a boiling solution it crystallizes on cooling in the form of delicate gold-like scales. It is blackened by sulphuretted hydrogen, owing to the formation of sulphuret of lead; and the iodine is disengaged in the form of hydriodic acid. Heat fuses it; and on being increased, decomposes it, and drives off iodine. It is composed of one equivalent of metal and one of iodine ($Pb+I$), and therefore of 103.6 parts of the former, and 126.3 of the latter.

Adulterations.—Its adulterations have not been particularly attended to. When it contains intermixed carbonate or combined oxide, it presents a lemon-yellow, instead of a gamboge-yellow, tint; and if boiled in successive portions of distilled water till all trace of yellow tint is removed, a grayish powder remains behind.

Actions and Uses.—Doubts are entertained as to its medicina actions. It was introduced into practice by M. Lugol of Paris, as a powerful local remedy in the form of ointment for chronic scrofulous tumours and ulcers; and it has been conceived to owe its virtues to its constitution as a compound of iodine. I have seen it repeatedly useful to appearance in obstinate ulcers, especially consecutive to mercurio-syphilitic eruptions in strumous habits. So much has been said in France of its effects as a compound of iodine in reducing strumous enlargement of glands when used in the way of friction, that the British Colleges could not but introduce it into their Pharmacopœias. Its physiological actions however do not correspond with its alleged therapeutic effects; for it has been shown, that in continued small doses it produces the constitutional action of lead, and not at all that of iodine (Cogswell. Paton). It is used only in the form of the *Unguentum plumbi iodidi.*

PLUMBI NITRAS, *E.* *Nitrate of lead.*

PROCESS, *Edin.* Take of
Litharge, four ounces and a half;
Diluted nitric acid, a pint.
Dissolve the acid to saturation, with the aid of a gentle heat. Filter and set the liquid aside to crystallize. Concentrate the residual liquor to obtain more crystals.

Chemical History.—NITRATE OF LEAD is obtained according to the process of the Edinburgh College by dissolving litharge with the aid of heat in diluted nitric acid, and crystallizing the solution by evaporation and cooling.

This salt forms beautiful tetraëdral and octaëdral crystals, nearly opaque, white, and of adamantine lustre. They are permanent in the air. They are soluble in somewhat more than four parts of water. Heat fuses the nitrate, and when increased, decomposes it, driving off various gaseous compounds of nitrogen, and leaving pure oxide of lead. When thrown upon burning fuel, it enlivens the combustion, and metallic lead is left. Its solution is affected by sulphuretted hydrogen, iodide of potassium, chromate of potash, the alkaline carbonates and sulphates, and metallic zinc, exactly in the same way as solutions of the acetate. The caustic fixed alkalis also act as upon the acetate. Ammonia tends to form white basic nitrates which are sparingly soluble. It is composed of one equivalent of each constituent ($PbO + NO^5$), and hence of 111.6 parts of protoxide of lead, and 54 parts of acid. It does not contain any water of crystallization.

Actions.—I have found nitrate of lead to be in large doses an irritant poison, somewhat resembling nitrate of potash in its action, It probably possesses the constitutional operation of the other compounds of lead. It has not been used in medical practice. And it is introduced into the Edinburgh Pharmacopœia merely as the best salt of lead from which to prepare the iodide.

PLUMBI OXYDUM, *L.* PLUMBI OXYDUM SEMIVITREUM, *D.* LITHARGYRUM, *E.*—*Protoxide of lead, fused. Litharge.*

TESTS, *Edin.* Fifty grains dissolve entirely, without effervescence, in a fluidounce and a half of pyroligneous acid; and the solution precipitated by 53 grains of phosphate of soda, remains precipitable by more of the test.

TESTS, *Lond.* Almost entirely soluble in diluted nitric acid; its other properties are the same with those of carbonate of lead.

FOR. NAMES.—*Fren.* Protoxide de plomb; Litharge.—*Ital.* Protossido di piombo; Litargiro.—*Span.* Litargirio.—*Ger.* Blei-oxyd; Bleiglatte.—*Dut.* Zilverschuim.—*Swed.* Silfverglitt.—*Dan.* Sölverglöd.—*Russ.* Glem.—*Pers.* Moordar sang.—*Tam.* Marudar singhie.

Chemical History.—WHEN lead is exposed in the melted state to a gentle current of air, and stirred, it is speedily converted into yellow, semicrystalline scales of protoxide, known in commerce by the name of Massicot. When this oxide is urged with a red heat,

it undergoes incomplete fusion, puts on the appearance of an oil, and on cooling, concretes into a loosely-aggregated mass of shining scales of a grayish-red tint. This is Litharge. A stronger heat fuses it completely, and the product on cooling is a translucent glass. Besides these different forms of oxide of lead there is a fourth in which it is united with water. This will be the subject of a separate article.

LITHARGE (oxide of lead, semivitrified oxide of lead, *chrysitis, argyritis, spuma argenti*) was known in ancient times. It is sometimes prepared expressly, sometimes obtained as a secondary product in the refining of gold and silver by means of lead. It has considerable weight,—a foliaceous structure when in mass, and a scaly appearance as usually sold,—a grayish-red colour, which is reddest in the specimens obtained in refining gold, and most gray as produced in refining silver,—considerable brilliancy, and neither taste nor smell. A strong heat fuses it into a glass; but if carbonaceous matter be present, it is reduced to the metallic state. It is said slowly to attract carbonic acid from the air. It is insoluble in water or spirit. It dissolves readily in diluted acetic or nitric acid, and without effervescence if pure; but there is commonly a slight effervescence from the presence of a little carbonate of lead. Other acids also unite with it to form neutral and basic or acidulous salts. It possesses the property of decolorizing many vegetable fluids. Wines for example, even port, are promptly rendered perfectly colourless by agitation with litharge. When heated with oils and fats along with water, it saponifies them, as in the preparation of the *Emplastrum lithargyri* (*plumbi, L.*). It consists of one equivalent of metal and one of oxygen (PbO), consequently 103.6 parts of lead, and 8 of oxygen.

Litharge is subject to adulteration with copper, carbonate of lead, and various express additions of inert earthy substances. These may be all guarded against by the formula of tests given in the Edinburgh Pharmacopœia. It ought to dissolve altogether, or at least very nearly so in diluted acetic acid, and with scarcely any effervescence; by the first of which characters the absence of such articles as sulphate of baryta is ascertained, and by the second the absence of carbonate of lead. The subsequent process of precipitation with phosphate of soda, applied by the Edinburgh College, to ascertain the purity of this and other compounds of lead, will detect all ordinary impurities exceeding one per cent. Good litharge never contains quite so much. The principles of the test have been explained under the head of the acetate and carbonate. The formula of the London College is also a good one. It requires almost absolute purity from all earthy matters soluble in nitric acid. Diluted nitric acid should dissolve litharge with faint effervescence only, and with but a scanty residuum; and the solution when decomposed by caustic potash deposits a precipitate which ought to be entirely soluble in an excess of the reagent. The other

characters given by the same College are not intended for discovering adulterations. The litharge made in this country is generally very pure; but that prepared on the continent often contains copper.

Actions and Uses.—Litharge may be presumed to possess the constitutional action of the preparations of lead; but it has not been particularly examined in this respect, and is not itself put to any use in medical practice. It is extensively used in the arts for making the other compounds of lead; and in pharmacy is employed for preparing the acetate, solution of diacetate, and lead-plaster.

PLUMBI OXYDUM HYDRATUM, *L.* *Hydrated oxide of lead.*

TESTS, *Lond.* This preparation when used for making disulphate of quina, should dissolve entirely in diluted nitric acid, and present the characters of oxide of lead in other respects.

PROCESS, *Lond.* Take of
Solution of diacetate of lead, six pints;
Distilled water, three gallons;
Solution of potash, six pints, or enough to throw down all the oxide.
Mix them; and wash the precipitate till the water which passes off ceases to be alkaline.

Chemical History.—THE preparation of the HYDRATED OXIDE OF LEAD from the diacetate is an instance of single decomposition. The potash must be added cautiously towards the close, so that a faint excess only may be present, otherwise some of the oxide is redissolved. The hydrate is also formed from the action of distilled water upon lead under exposure to the air. But unless the air be deprived of carbonic acid, the hydrate is converted partly into the carbonate of lead.

The hydrated oxide, as obtained by the College process, is a pure white, tasteless, heavy powder, which by heat is converted into the yellow protoxide, with the escape of water. It is very sparingly soluble in distilled water, and gradually separates from it in the form of carbonate when the water is left exposed to the air. It is very soluble in nitric and acetic acids, and is likewise dissolved by solution of potash. Sulphuretted-hydrogen renders it black, owing to the formation of sulphuret of lead. Like litharge, and in a greater degree than that substance, it possesses the property of decolorizing many coloured vegetable fluids. It is composed of three equivalents of oxide of lead and one equivalent of water ($3\ PbO + HO$) as thrown down from the acetate of lead by potash,—that is 334.8 parts of oxide and 9 of water.

Actions.—Its actions on the animal body have not been examined. But there can be little doubt that it possesses the properties of the lead compounds generally. The London College has introduced it merely as a pharmaceutic agent required for the process for making sulphate of quina. As that process appears to be far from a convenient one, the present addition to the Pharmacopœia might be dispensed with.

PLUMBI OXYDUM RUBRUM, *E.* *Red Oxide of lead. Red-lead. Minium.*

TESTS, *Edin.* Entirely soluble in highly fuming nitrous acid: partially soluble in diluted nitric acid, a brown powder being left.

FOR. NAMES.—*Fren.* Oxide rouge de plomb; Minium.—*Ital.* Minio.—*Span.* Minio.—*Ger.* Mennig; Rothes bleioxyd; Blei-hyperoxydul. —*Dut.* Mennie. —*Swed.* Mönja.—Mönnie.—*Arab.* Isrenj.—*Tam.* Segapoo sendoorum; Eeum sindoorum.—*Beng.* Sendoor.

IT is not ascertained at what time RED OXIDE OF LEAD was discovered. The *Minium* of the Romans appears to have been vermilion, and not this substance. The alchemysts in the thirteenth century knew how to prepare it.

Chemical History.—It is obtained from the protoxide of lead by exposing this preparation, under the access of air, to a temperature just short of what is required to cause fusion, stirring it occasionally for a day and a half or upwards, and allowing the product to cool slowly. It is a heavy, tasteless powder, of a bright scarlet colour. Heat renders it darker, and when raised, fuses it, with the disengagement of oxygen, and its reconversion into protoxide. It is insoluble in water. Nitrous acid, as stated in the Edinburgh formula of tests, dissolves it entirely, forming nitrate of protoxide of lead; because the excess of oxygen in red-lead converts the nitrous into nitric acid. Diluted nitric acid instantly renders it dark-brown, resolving it into two oxides, one of them the protoxide, which is dissolved, and the other the peroxide or binoxide, which remains. Chemists differ as to the constitution of red lead. But it is now most commonly considered to consist of three equivalents of lead and four of oxygen, so united as to constitute it a compound of two equivalents of protoxide and one of peroxide or plumbic acid ($2\,PbO + PbO^2$), that is 223.2 parts of the former oxide, and 119.6 of the latter.

It is little subject to adulteration. Brick-dust is sometimes mixed with it. This is best detected by the solvent action of nitrous acid, which leaves the impurity.

Actions.—Its actions have not been examined. It is sometimes used as a desiccative sprinkled upon sores. It is admitted into the Edinburgh Pharmacopœia for purifying concentrated acetic acid, and for preparing chlorinewater.

PLUMBI SUBACETATIS LIQUOR, *D.* See *Plumbi diacetatis liquor.*

POLYGALA, *D.* See *Senega.*

POLYGONUM BISTORTA, *D.* *Root of Polygonum Bistorta, L. W. Spr. Bistort.*

FOR. NAMES.—*Fren.* Bistorte —*Ital. Spa.* and *Port.* Bistorta.—*Ger.* Natter-

knöterig; Schlangenkraut.—*Dut.* Naterwortel.—*Dan.* Stangeurt.—*Swed.* Ormrot.—*Russ.* Serteschnaia trava.

Figures of Polygonum Bistorta in Nees von E. 105.—Hayne, v. 13.—Engl. Bot. 509.—Steph. and Ch. i. 47.

Bistort has been long used in European medicine; but it cannot be clearly referred to either of the plants known to Dioscorides by the name of Πολυγονον, which were probably other species of the same genus.

The *Polygonum Bistorta* is a common native of this country, inhabiting moist meadows. It belongs to the Linnæan class and order *Octandria Trigynia*, and to the Natural family *Polygonaceæ*, to which it has given its generic name. It has a perennial root, and an annual herbaceous stem, towards three feet in height, and terminating in a dense spike of rose-coloured flowers which blow in June. The root has a double twist, whence is derived the specific name of the plant. This is its only officinal part. It is dark-brown externally, without odour, and of a strong pure astringent taste. It must contain a large quantity of tannin; but it has not been carefully analyzed.

It is one of the most powerful of indigenous astringents, and has been used as a constitutional astringent in chronic hemorrhagies and mucous discharges, and also locally in relaxed sore-throat and in leucorrhœa. At present it is very seldom prescribed.

Its dose in powder is from 30 to 40 grains.

PORRUM, *L.* *Root of Allium Porrum, L. W. Spr.* *The Leek.*

For. Names.—*Fren.* Poireau.—*Ital.* Porro.—*Span.* Puerro.—*Ger.* Lauch.—*Dut.* Look.

Although the Leek, the Πρασον κηπαιον of the Greek physicians, was considered by them a diuretic, laxative, expectorant, and emmenagogue, and appears to have been in their eyes an important remedy, I do not know why it is still retained in the London Pharmacopœia; for it is now never used medicinally; and as an article of diet, it is apt to excite flatulence with many, so that it cannot well be employed as an alimentary substance in the dietetic treatment of diseases. In its characters, properties, and composition it closely resembles the onion.

POTASSA, *E.* POTASSAE HYDRAS, *L.* POTASSA CAUSTICA, *D.* *Potash.* *Hydrate of Potash.* *Protoxide of potassium.*

Tests, *Edin.* Boiling water commonly leaves oxide of iron undissolved, which should not exceed 1.25 per cent. The solution, supersaturated with nitric acid, gives a faint precipitate (only) with solution of nitrate of baryta, and more with solution of nitrate of silver,—owing to the presence of impurities.

Tests, *Lond.* It soon deliquesces if exposed to the air: soluble entirely in alcohol: other properties the same as those of *Potassæ Aqua.*

PROCESS, *Edin.* Take any convenient quantity of Aqua potassæ; evaporate it in a clean and covered iron vessel, increasing gradually the heat, till there remains an oily-looking fluid, a drop of which, when removed on a glass-rod, becomes hard on cooling. Then pour out the liquid upon a bright iron plate; and as soon as it solidifies, break it quickly, and put it into glass bottles, secured with glass stoppers.

PROCESS, *Lond.* Take of solution of potash, one gallon. Evaporate it over the fire in a clean iron vessel till all ebullition ceases, and the fused hydrate of potash is left; which is to be poured into proper moulds.

PROCESS, *Dub.* Take any quantity of solution of caustic potash. Evaporate it in a clean iron or silver vessel till the saline matter, on increasing the heat, remains at rest. Pour this upon an iron or silver plate, and while it congeals, cut it into pieces, and put them into a well-closed phial. Avoid the drops spurted up during the evaporation.

FOR. NAMES.—*Fren.* Potasse; Potasse caustique.—*Ital.* Potassa.- *Ger.* Kali; Kaliumoxyd.—*Russ.* Lutoe vodnoe kali.

POTASH (Potassa; Pure potash; Caustic potash; Pure kali; Pure lixivium; *Lapis infernalis, Cauterium potentiale*) seems to have been known in the pure and solid form so early as the thirteenth century, and in solution much earlier. It has been known by many other pharmaceutic names besides those just mentioned. The newest and most refined is that of the London College; which might with equal propriety have added the term Hydrate to every hydrated salt in the Pharmacopœia.

Chemical History.—Two varieties must be carefully distinguished—the Caustic potash of commerce, which is alone used in medical practice, as well as in the shop of the druggist, and Pure potash prepared expressly for the use of the scientific chemist. It is for the former of these that the College processes are designed. The directions they contain are sufficiently precise to require little explanation. The solution of potash should be recently prepared. So long as the temperature is maintained at the point of ebullition, carbonic acid is not absorbed from the atmosphere; but if the evaporation be interrupted, and the liquid allowed to cool, the alkali becomes quickly carbonated. It is unnecessary to use a silver vessel, this being required only when a very pure potash is to be made. An iron vessel indeed, however clean it may be, always imparts some oxide of iron to the potash; but not in such quantity as to interfere with any of its medicinal or common pharmaceutic applications. The contact of all organic substances, and of all the common metals except iron or silver, must be carefully avoided. The fused potash is sometimes poured upon a clean iron plate to cool and congeal; but for all purposes it is more conveniently run into cylindrical moulds, such as are employed for making rods of nitrate of silver. In order to obtain pure potash for scientific purposes, a very pure carbonate of potash must be used for preparing *Aqua potassæ*: this solution is then to be evaporated in a vessel of silver or platinum to the consistence of syrup, and the cooled liquor agitated with a third of its weight of alcohol; and when the mixture has remained at rest for a little, the clear fluid is to be de-

canted and immediately evaporated till an oily-like matter is obtained.

The potash of pharmacy is sold in the form of fragments of plates or of cylindrical pencils, of a gray colour, fibrous fracture, and intense corrosive alkaline taste. When handled in the moist state it feels soapy. It is exceedingly deliquescent, and in thus dissolving, attracts at the same time carbonic acid powerfully from the atmosphere. Acids combine with it, causing the evolution of much heat; and crystallizable salts are formed. It is very soluble in water and alcohol. It generally effervesces when dissolving in water, as it contains generally some peroxide of potassium, which is resolved by the water into oxygen and potassa. The aqueous solution presents the characters described under the article *Aqua potassæ.* It powerfully corrodes the soft animal textures; and when it has thus acted on them, extensive inflammation ensues around, preparatory to the separation of a deep slough. It is composed of one equivalent of potassium, one of oxygen, and one of water (KO + Aq.), and therefore of 39.15 parts of metal, 8 of oxygen, and 9 of water.

Adulterations.—The common potash of the shops being necessarily always impure, it is not easy to lay down characters for detecting adulterations. It contains alkaline sulphates and muriates, oxide of iron, silica, and often alumina. The Edinburgh College indicates one grain and a quarter per cent of oxide of iron as the greatest amount of that impurity which should be left on dissolving it in water; and, pointing out muriates and sulphates as farther admixtures, seldom altogether absent, and easily discovered by the action of nitrate of baryta and nitrate of silver on the potash solution supersaturated by nitric acid,—the operator is left to judge of the degree of impurity by his own experience. Carbonate of potash, which may be often present also, is detected by the solution of potash effervescing with nitric acid. There is no sample of the ordinary potash of the shops which will answer to the London character of purity,—complete solubility in alcohol.

Actions and Uses.—Potash is a very powerful corrosive, probably indeed the most powerful of all pure corrosive poisons. It dissolves the textures to which it is applied, first attracting their water and then disorganizing them entirely. Its special effects on the human body are not so thoroughly known as those of the carbonate, but are probably the same in kind, and greater in degree. It has no action as a poison except what depends directly on the local injury occasioned: it exerts no indirect influence through the medium of absorption. Its poisonous properties are neutralized in a great measure or entirely, when it is united with those acids which, like itself, are pure corrosives or irritants. Vinegar and lemon-juice, or the fixed oils, are its antidotes. In medicine, potash is never employed internally, except in the form of solution; but, like its solution, it must be antacid, antilithic, and probably diuretic.

Its compounds with the acids are generally purgative and diuretic, unless where other properties are imparted through means of the peculiar actions of the acids combined with it. Potash in its solid state is only used externally in medical practice; and its chief application is for making caustic issues. For this purpose the integuments around the part to be acted on are protected by two or three layers of cloth, spread with adhesive plaster, and perforated with a circular hole an inch or more in diameter; and then a rod of potash, slightly moistened at the end, is gently rubbed over the circular portion of skin till the surface be destroyed. After the slough separates, the retraction of the surrounding skin always makes the surface of the issue much larger than the circle originally cauterized; the extent of which must be regulated accordingly. It may be used in like manner for the destruction of tumours, and of the surfaces of unhealthy or malignant ulcers; but the potential cautery is little employed now-a-days for these purposes.

POTASSAE ACETAS, *E. L. D.* *Acetate of Potash.*

TESTS, *Edin.* Not subject to adulteration.
TESTS, *Lond.* Entirely soluble in water and alcohol: it does not affect litmus or turmeric, and is not affected in solution by chloride of barium or nitrate of silver, unless the solution be strong, in which case any precipitate formed by the silver test is redissolved by water or nitric acid. A red heat converts it into carbonate of potash. Sulphuric acid disengages acetic vapours.

PROCESS, *Edin.* Take of
Pyroligneous acid, a pint and a-half;
Carbonate of potash (dry), seven ounces or a sufficiency.
Add the carbonate gradually to the acid till complete neutralization be accomplished. Evaporate the solution over the vapour-bath till it is so concentrated as to form a concrete mass when cold. Allow it to cool and crystallize in a solid cake; which must be broken up and immediately put into well-closed bottles.

PROCESS, *Lond.* Take of
Carbonate of potash, a pound;
Acetic acid, twenty-six fluidounces;
Distilled water, twelve fluidounces.
Add the Carbonate of potash to the acid and water till saturation take place; and filter. Evaporate the liquid in a sand-bath till the salt be dried, applying the heat cautiously.

PROCESS, *Dub.* Take of Carbonate of potash from Tartar, any quantity. Add gradually about five times its weight of Distilled vinegar moderately heated. Evaporate the solution, and then add more distilled vinegar till effervescence ceases. Then evaporate to dryness, and liquefy the salt by cautiously raising the heat. Dissolve the salt in water, filter the solution, and evaporate it till it becomes on being cooled a white crystalline mass. Put this immediately into well-closed vessels.

FOR. NAMES.—*Fren.* Acetate de Potasse.—*Ital.* Acetato di potassa.—*Ger.* Essigsaures kali.—*Russ.* Uksusnokisloe kali.

ACETATE OF POTASH was described by Raimund Lully in the thirteenth century. It exists according to Berzelius in many plants; but what is used in medicine is all obtained by artificial processes.

Chemical History.—The method long practised was to neutralize distilled vinegar with carbonate of potash, and obtain the salt by evaporation, as still directed by the Irish College. The employment of distilled vinegar, however, always involves great nicety of manipulation. For as the solution becomes concentrated, it also

acquires a brown colour; and the only convenient way to get rid of the colour is, by raising the heat slightly after all the moisture is driven off except the water of crystallization, maintaining the salt for some time in a state of fusion, and then dissolving it and evaporating again to dryness. This process, besides being troublesome, is attended with the risk of decomposition of the salt, if the fusing heat should accidentally rise too high. If instead of distilled vinegar, a colourless pyroligneous acid be used, and the carbonate be also of good quality, a salt is obtained at once by evaporation, presenting the necessary whiteness and purity for medicinal use. The chief precautions to be attended to are, that there shall be no excess of alkali, but rather the reverse, otherwise the free alkali reacts on the acid of the salt when the solution is much concentrated, and discoloration ensues,—and that the drying heat shall be carefully regulated, not by the vapour-bath (E. P.) the temperature of which is too low for thorough desiccation, nor by the sand-bath (L. P.) which may easily raise the temperature too high, but on the small scale by the muriate of lime-bath, and on the large scale by steam under pressure.

Acetate of potash may be crystallized, but with difficulty, in transparent colourless needles. As sold in the shops, it always forms white, foliaceous, sattiny masses, not unlike spermaceti, soapy to the touch, without odour, but of a strong saline, warm, and rather acrid taste. It is exceedingly deliquescent, and must therefore be carefully excluded from the air. Heat fuses it, and then decomposes it, partly driving off and partly disorganizing its acid; so that at length carbonate of potash is left. It is soluble in half its weight of temperate water (Phillips), and in four parts of rectified spirit (Powell). The solution is known by giving off an acetous odour on the addition of sulphuric acid, and yielding a yellow precipitate with chloride of platinum. It is decomposed by the stronger acids and by some metallic salts; and therefore it should be prescribed without any such additions. It is composed of one equivalent of acid, one of base, and two of water ($\bar{A}+KO+2Aq$), and consequently of 51.48 parts of acetic acid, 47.15 potash, and 18 water.

Adulterations.—The London College has given characters partly for recognizing it, partly for ascertaining its purity. But in point of fact it is scarcely ever adulterated, and never to such a degree as to be of any consequence in respect of its medicinal applications. The characters laid down by the College are too simple to require explanation.

Actions and Uses.—Acetate of potash is chiefly known as a cathartic and diuretic. It acts with considerable certainty in both ways, and is accordingly used with advantage as a purgative diuretic in dropsy. In small repeated doses its diuretic effect is most generally the principal action developed. Its purgative action is best produced by doses of a drachm and a half or two drachms.

This salt is probably not so much in use as it ought to be. As a diuretic particularly, it is often most energetic. Among others, my predecessor *Dr Duncan* used it extensively with favourable results in dropsy; and *Alibert* thought it the best of diuretics in hydrothorax. Its applications to the treatment of jaundice and other visceral obstructions are not well supported by facts. It should be given simply in a state of diluted solution, to which a little sugar may be added, if thought necessary.

Its doses are gr. x. ad gr. xx. as a diuretic, and dr. iss. ad dr. ii. as a laxative.

POTASSAE AQUA, *E.* POTASSAE LIQUOR, *L.* POTASSAE CAUSTICAE AQUA, *D.* *Solution of Potash.*

Tests, *Edin.* Density, 1072.—*Dub.* 1080.

Tests, *Lond.* Its density is 1063. It turns turmeric brown. It effervesces very little, if at all, when neutralized with diluted nitric acid; and the solution should scarcely precipitate with carbonate of soda, chloride of barium, or nitrate of silver; but it yields an abundant yellow precipitate with chloride of platinum.

Process, *Edin.* Take of
Carbonate of potash (dry), four ounces;
Lime, recently burnt, two ounces;
Water, forty-five fluid-ounces
Let the lime be slaked and converted into milk of lime with seven fluidounces of the water. Dissolve the carbonate in the rest of the water; boil the solution, and add the milk of lime in successive portions, about an eighth at a time, boiling briskly for a few minutes after each addition. Pour the whole into a deep, narrow glass-vessel for twenty-four hours; and then withdraw with a syphon the clear liquid, which ought to amount to at least thirty-five fluidounces, and should have a density of 1072.

Process, *Lond.* Take of
Carbonate of potash, fifteen ounces;
Lime, eight ounces;
Boiling distilled water, a gallon.
Dissolve the carbonate in half of the water. Let the lime be slaked with a little of the water in an earthen vessel: add the rest of the water; mix the liquors immediately in a close vessel, and agitate frequently till they are cold. Set it aside, that the carbonate of lime may settle; pour off the supernatant liquor; and keep it in a well closed green-glass bottle.

Process, *Dub.* Take
Carbonate of potash, and
Lime fresh-burnt, of each two parts;
Water, fifteen parts.
Let the lime be slaked in an earthen dish with a little of the water; then immediately mix the salt, and add the rest of the water. When the mixture has cooled, put it into a well-closed bottle, and agitate frequently for three days When the carbonate of lime has subsided, decant the clear liquor and keep it in well closed green-glass bottles. Its density is 1080.

Caustic Potash in a state of solution in water (Caustic Lixivium, Kali-water, Soap-maker's-ley, Potash-water) seems to have been known to the ancients; and Paulus Ægineta, as well as Geber in the eighth century, showed how it may be obtained by lixiviating a mixture of carbonate of potash and lime fused together. Dr Black was the first to methodize the liquid process which is still followed; but the manipulations have been of late much improved as regards facility and dispatch.

Chemical History.—A tolerably pure carbonate of potash must in the first place be used; and if the object is to have a pure solution for delicate chemical purposes, the carbonate ought to be prepared by incinerating bitartrate of potash, previously once or twice crystallized, and the lime to be made use of should be obtained from a

pure marble or calcareous spar. Good spring-water is sufficient for a pharmaceutic solution; but for a pure one distilled water must be taken, as the London College directs. The minutiæ of the process are by no means unimportant. Filtration, which was enjoined by the previous editions of the Pharmacopœias, is advantageously dispensed with, both as being tedious, and therefore exposing the potash to become carbonated, and because it is sometimes apt to introduce organic matter into the solution. By the process of subsidence, it is true, a portion is left with the carbonate of lime at the bottom of the vessel; but this does not exceed a seventh of the whole solution when the process is well conducted; and it may be recovered on the great scale by the affusion of boiling-water and a second subsidence, and used in this state instead of water for making the strong solution. The proportions of the salt, the lime and the water are of material consequence. Formerly, too much lime was used. Half as much lime as there is of carbonate has been found sufficient; but the proportion cannot be farther reduced. Water must be used in the proportion of about ten parts (by weight) to one of carbonate, otherwise a portion of the salt escapes decomposition; and no increase in the proportion of lime will prevent that result. The decomposition of the carbonate is greatly accelerated by ebullition, which has likewise the advantage of increasing the density of the particles of carbonate of lime that is formed, and so rendering their subsidence more complete. The last-mentioned object is farther secured by adding the milk of lime in successive portions, and renewing the ebullition after each (Berzelius). Having verified these statements by careful trials, I have no doubt that the details of the Edinburgh formula are superior to those of the two other Pharmacopœias in facility, despatch, economy, and perfection. The Dublin process is faulty as enjoining twice the necessary lime, and too little water,—so little indeed that, unless with the common watery carbonate of potash of the shops, a perfect caustic potash-solution cannot be obtained. The London formula is better; but by omitting ebullition after the ingredients are mixed, and continuing the agitation till the liquor is cold, much time is lost, and the subsidence is not so complete.

The solution of the Pharmacopœias is a colourless, transparent fluid, which feels soapy, is without odour, and has an intense, alkaline, caustic taste. It turns turmeric brown, renders litmus purple, and infusion of violets, red cabbage, and most blue vegetable colours green. It rapidly absorbs carbonic acid from the air; which must therefore be carefully excluded from the bottles in which it is kept. Heat alters it no farther than by concentrating it, until at length pure caustic potash is obtained. If the evaporation be stopped when the density reaches 1600, crystals may be formed by slow refrigeration, which are four-sided prisms, four-sided tables, or octaëdres (Geiger). Solution of potash is an energetic agent in

chemistry and pharmacy, by reason of the powerful affinity of its alkali for the acids. It decomposes the salts of ammonia and disengages that alkali,—also the earthy salts, throwing down oxides of the earthy metalloids,—likewise most metallic salts, separating metallic oxides, but redissolving some of them when added in excess, —and lastly many vegetable infusions containing alkaloids or neutral crystallizable principles, which it detaches more or less pure, in the free state and insoluble. It saponifies most oils and fats, converting the neutral principles of which they are composed into fatty acids, which unite with the potash to form soaps, or fatty salts of definite composition. It acts with great intensity on the soft animal textures, as well as on many vegetable tissues; which it disorganizes, corrodes, or altogether dissolves.

Adulterations.—As solution of potash is scarcely ever purchased by the druggist on the large scale, but is made by retailers themselves, it is not necessary to be minute as to its impurities. It is never expressly adulterated: but may be faulty from errors in preparing it. It ought to have a density of 1072 when prepared by the Edinburgh formula, and of 1063 when made by that of London. Its effects on turmeric and on chloride of platinum, specified by the latter College, are intended merely for distinguishing it. The other characters relate to impurities. If it should effervesce on being neutralized by diluted nitric acid, it is not altogether caustic. Should the neutral solution undergo precipitation with carbonate of soda, there is lime present; if with muriate of baryta, there is sulphuric acid; and if with nitrate of silver, there is muriatic acid. None of the potash-waters of the shops, however, will entirely resist the last two tests; nor is it necessary for their pharmaceutic or therapeutic uses that they should do so absolutely. In order to prevent an impregnation of silica, the solution of potash ought to be kept, not in crown-glass, but in green-glass bottles.

Actions and Uses.—The actions of this preparation correspond in a great measure with those of the carbonate, and likewise of potash itself. It is a powerful corrosive; and, as such, an energetic poison in large doses, and undiluted. In smaller quantity it is an irritant. It is a pure irritant and corrosive; it does not exert any constitutional action except what depends on the local injury it occasions. In medicinal doses it possesses antacid and antilithic properties, and in these respects it is undistinguishable from the carbonate or bicarbonate of potash. As an antacid it has been used in dyspepsia, as well for correcting acidity generally, as for preventing gastrodynia more especially; and of late, in the practice of not a few physicians, it has been preferred to all other alkaline remedies in these affections, whether idiopathic, or connected with such chronic eruptive diseases as lepra and psoriasis. It is extraordinary how it should be considered in any way preferable to the carbonate of potash in dyspeptic complaints; because the small doses which are, and may alone be, administered, must be instantly

converted into carbonate on coming in contact with the carbonic acid largely contained in the gases, secretions, and other contents of the stomach. As an antilithic and lithontriptic, it has been thought superior to other forms of the alkalis, on the inconclusive ground, that it surpasses them in solvent power over the matter of certain urinary concretions out of the body. Within the body it can only exist as a carbonate. When administered inwardly it is commonly given along with some aromatic distilled water, to cover its taste,—always much diluted, to remove its acrimony,—and sometimes along with simple bitter infusions, to unite a tonic with an antacid action, in dyspepsia and cutaneous diseases.

The dose of *Aqua potassæ* is m. x. ad fl.dr. ss.

POTASSAE AQUA EFFERVESCENS, *E.* LIQUOR POTASSAE EFFERVESCENS, *L.* *Kali-water.* *Solution of bicarbonate of potash, surcharged with carbonic acid.*

PROCESS, *Edin. Lond.* Take of
Bicarbonate of potass, one drachm ;
Distilled water, a pint.
Dissolve the salt in the water, and transmit through the solution carbonic acid gas under strong pressure (till more has passed than suffices for saturation ; and preserve the solution in well-closed vessels, L.)

WHEN a weak solution of bicarbonate of potash is strongly charged with carbonic acid under high pressure, there is produced the Kali-water of the shops, now frequently used instead of soda-water. Its preparation, action and uses are identical with those of the familiar soda-water, or *Sodæ aqua effervescens*; to which the reader is accordingly referred. It has the advantage over soda-water, that when used as drink, the after-taste is more purely saline, and without any alkalinity. It is distinguished by being highly effervescent, and by the solution, which remains after the escape of the excess of gas, yielding a yellow precipitate when treated with the chloride of platinum. The latter character distinguishes it from the similar preparation of soda. Like soda-water, it is sometimes made with too little salt.

POTASSAE BICARBONAS, *E. L. D.* *Bicarbonate of potash.*

TESTS, *Edin.* A solution in forty parts of water does not give a brick-red precipitate with solution of corrosive sublimate ; and when supersaturated with nitric acid, is not affected by solution of nitrate of baryta or nitrate of silver.

TESTS, *Lond.* Entirely soluble in water. The solution affects turmeric faintly, and is not affected by sulphate of magnesia unless heated. One hundred parts lose 30.7 at a red-heat. When supersaturated by nitric acid, chloride of barium does not affect it, and nitrate of silver causes very little, if any, precipitate.

PROCESS, *Edin.* Take of
Carbonate of potash, six ounces ;
Carbonate of ammonia, 3½ ounces.
Triturate the carbonate of ammonia to a fine powder ; mix with it the carbonate of potash ; triturate them thoroughly together, adding by degrees a very little water, till a smooth and uniform pulp be formed. Dry this gradually at a temperature not exceeding 140°, triturating occasionally towards the close ; and continue the desiccation till a fine powder be obtained, entirely free of ammoniacal odour.

PROCESS, *Lond.* Take of
Carbonate of potash, six pounds ;
Distilled water, one gallon.
Dissolve the carbonate in the water ;

pass carbonic acid through it to saturation; apply a gentle heat to redissolve any crystals that may have formed; and then set the solution aside to crystallize. Pour off the liquor and dry the crystals. —Carbonic acid is obtained from chalk rubbed with water to the consistence of syrup, upon which is poured a mixture of equal weights of sulphuric acid and water.

PROCESS, *Dub.* Take of

Carbonate of potash, prepared from pearl-ash, one part;

Distilled water, two parts.

Dissolve the salt in the water; transmit carbonic acid gas, from the action of diluted muriatic acid on marble, till the solution becomes turbid; filter; transmit the gas again to saturation; leave the solution in a cool place till crystals form, which are to be dried without heat and kept in a well-closed bottle.

FOR. NAMES.—*Fren.* Bicarbonate de potasse.—*Ital.* Bicarbonato di potassa.—*Ger.* Doppelt kohlensaures kali.—*Russ.* Dvuch-uglekisloe kali.

BICARBONATE OF POTASH, known in former editions of the Pharmacopœias under the name of Carbonate, was first prepared by Cartheuser in 1757. It exists in small quantity in some mineral waters. The salt used in medicine is all prepared from the carbonate by the manufacturing chemist.

Chemical History.—It may be obtained in various ways. But the process generally followed consists in charging a solution of the carbonate with carbonic acid by means of a stream of the gas, or in deriving the additional carbonic acid from the decomposition of the sesquicarbonate of ammonia in contact with the carbonate of potash. The former method is that of the present London and Dublin Pharmacopœias. For this process it is desirable that a pure carbonate of potash be used; for in that case the gas may be transmitted to saturation without interrupting the process. But if an impure salt containing silica be employed, as the Dublin College directs, it is necessary to interrupt the transmission of the gas at a certain stage, in order to filter the solution, which becomes muddy from the deposition of siliceous impurities. The method by transmission of gas is not convenient upon the small scale, because the gas is very slowly absorbed except under pressure,—a fact which neither the London nor Dublin College has taken notice of. Hence manufacturers either employ considerable pressure to facilitate absorption, or adopt the plan of simply exposing the alkaline solution for a long time to an atmosphere of carbonic acid, as in a brewer's vat during the progress of fermentation. The process by decomposition of the sesquicarbonate of ammonia is superior to the former in point of economy, despatch, and certainty in small operations. This process may be followed either in the moist or dry way. The usual practice is to heat a solution of carbonate of potash in its own weight of water, with about half its weight of sesquicarbonate of ammonia, to about 130°, and to stir occasionally until in the course of evaporation small crystals begin to form. Ammonia is given off in great quantity, and the carbonic acid of the ammoniacal carbonate is appropriated by the carbonate of potash; so that, under slow cooling, crystals of bicarbonate of potash are formed. The first crop of crystals is very pure; but if an attempt be made to concentrate the solution farther, to obtain more, carbonic acid is

given off, and the subsequent crystals contain a little carbonate. It is better, therefore, to use the residual solution for a fresh operation, adding to it the requisite carbonate of potash and sesquicarbonate of ammonia. I have found that the same process may be conducted very well on the small scale in the dry way. The carbonate of potash being intimately mixed with somewhat more than half its weight of finely-powdered sesquicarbonate of ammonia, the mixture, with the addition of a very little water, is to be subjected to brisk trituration until a perfectly smooth thick pulp is formed. Ammonia is given off largely; and by subsequently drying the pulp in a hot air-press, and triturating occasionally, more ammonia is discharged, together with the excess of sesquicarbonate. A pure bicarbonate of potash is thus easily obtained in the state of powder. The minutiæ requisite for success are fine trituration of the ammoniacal salt before it is added to the carbonate of potash, thorough intermixture of the salts, a temperature not much exceeding 130° or 140°, and exposure to that degree of heat until an ammoniacal odour ceases to be given off. This is the process of the Edinburgh Pharmacopœia.—Wöhler says the bicarbonate of potash may be speedily and cheaply prepared in the following manner. Crude tartar is charred in an earthen-ware crucible, moistened with water, packed in a glass vessel, and subjected to a stream of carbonic acid gas. The gas is absorbed so fast that the heat produced must be kept down by cooling the vessel. When the absorption of gas ceases, the mass is lixiviated with water at 100° F.; and crystals of pure bicarbonate form as the solution cools.

Bicarbonate of potash readily crystallizes in transparent, colourless, right-rhombic prisms, usually truncated on the acute edges. Their primitive form is the rectangular octaëdre. This salt is without odour, and of a mild saline taste, with scarcely any alkalinity. Heat expels carbonic acid from it, and reduces it to the state of carbonate,—a change which takes place partially even below the temperature of 212°. It is soluble in four parts of temperate water, and in rather less than its own weight at 212°. Protracted ebullition converts its solution into the sesquicarbonate. Its reactions on the earthy and metallic salts are in general widely different from those of the carbonate. Sulphate of magnesia and corrosive sublimate, in a moderately diluted solution, do not yield any precipitate with bicarbonate of potash. It is composed of two equivalents of acid, one of base, and one of water ($2\ CO^2 + KO + Aq$), and therefore of 44.24 parts of carbonic acid, 47.15 of potash, and 9 of water. It has no power of dissolving or disorganizing the animal textures.

Adulterations.—The usual adulterations of bicarbonate of potash are with sulphate and muriate of potash, in consequence of an impure carbonate of potash having been used to make it, and with carbonate of potash from defective preparation. Sulphate and muriate of potash are detected by nitrate of baryta and nitrate of

silver occasioning a white precipitate in its solution when supersaturated by nitric acid. Carbonate of potash is best detected, as the Edinburgh College directs, by a solution of corrosive sublimate; which, with a solution of pure bicarbonate in forty parts of water, has either no effect at all or causes a white haze merely, but immediately produces a brick-red precipitate if the salt contains even so little as a hundredth part of carbonate. Sulphate of magnesia, which has been recommended for the same purpose by the London College, is altogether useless: even where fifty per cent of carbonate of potash is present with the bicarbonate, a precipitate is not occasioned.

Actions and Uses.—The bicarbonate closely resembles the carbonate of potash in most of its actions. It is not, like it, a corrosive or powerful irritant, and therefore can scarcely be considered a poison. But it is equally powerful as an antacid and antilithic; it possesses the same diuretic properties; and it has the advantage of being less unpleasant to the taste, and so little irritating that it may be administered in much larger doses. As an antilithic it is preferable to the carbonate, for reasons which will be found explained under the head of carbonate of soda. It is commonly given in the state of simple solution; which, however, may be sweetened with sugar and aromatized with any distilled water, if the patient prefer it so.——It is sometimes used for making effervescing powders; but the bicarbonate of soda, which answers equally well, is commonly preferred, because much cheaper.

Its dose is gr. x. ad gr. xx. as an antacid or antilithic, and dr. i. ad dr. ii. as a diuretic.

POTASSAE BISULPHAS, *E. L. D.* *Bisulphate of potash.*

TESTS, *Edin.* A solution in eight waters effervesces briskly with alkaline carbonates.

PROCESS, *Edin. Lond.* Take of
The residuum in the preparation of pure nitric acid, two pounds;
Commercial sulphuric acid, seven fluidounces and one fluidrachm (one pound, L.);
Boiling water, six (four, L.) pints.
Dissolve the salt in the water, add the acid, concentrate the solution, and set it aside to cool and form crystals.

PROCESS, *Dub.* Take of
Sulphuric acid, two parts;
Carbonate of potash from pearl-ash, a sufficiency;
Water, six parts.
Neutralize with the carbonate one part of the acid diluted with the water, add the rest of the acid, and evaporate the solution sufficiently for it to crystallize on cooling.

FOR. NAMES.—*Fren.* Bisulphate de potasse.—*Ital.* Deuto-solfato di potassa.—*Ger.* Doppelt schwefelsaures kali.—*Russ.* Dvuch-sernokisloe kali.

BISULPHATE OF POTASH (supersulphate of potash; *Sal auri philosophicum*) seems to have been first prepared by Lowitz towards the close of the last century (Geiger).

Chemical History.—It may be obtained according to the process of the Dublin College by moderately diluting the commercial sulphuric acid, neutralizing it with carbonate of potash, then adding as much acid as was used at first, and evaporating the solution so far, that on cooling it concretes into a uniform crystalline mass.

Crystals however cannot be obtained with these proportions; because if no more acid be present than is required to form a bisulphate, and the evaporation be stopped at an earlier stage than that indicated in the formula, the crystals which separate on cooling are chiefly neutral sulphate. In order to obtain crystals of bisulphate a large excess of sulphuric acid must be used. This measure constitutes part of the process of the London and Edinburgh Colleges; which however also deviates from the Dublin formula, by directing the operator to make use of the bisulphate obtained as refuse in the making of nitric acid.

Bisulphate of potash forms small oblique four-sided prisms when crystallized; and when obtained by extreme concentration and cooling, it has the appearance of a firm, fibrous, white mass. Both forms have a strong acid taste. The crystals are permanent in dry air; but the concreted fibrous mass effloresces. A strong heat fuses it, without occasioning any other change. It is exceedingly soluble in water. It is composed of two equivalents of acid, one of base, and two of water, when crystallized, and consequently of 80.2 parts of sulphuric acid, 47.15 of potash, and 18 of water ($2\ SO^3 + KO + 2\ Aq$). It may be distinguished from other salts by its strong acid taste, by the brisk effervescence occasioned on projecting an alkaline carbonate into its solution, and by the solution, neutralized in that way, presenting the characters of the neutral sulphate.

Actions.—The properties of this salt have not yet been fully investigated. It is a laxative. It supplies a cheap substitute for tartaric acid in making effervescing powders (Barker). A drachm of bisulphate and as much carbonate make a good effervescing powder, which might be used with advantage in hospitals instead of the more expensive tartaric acid.

Its dose is from one to two drachms.

POTASSAE BITARTRAS, *E. L. D.* *Bitartrate of potash.*

TESTS, *Edin.* Entirely soluble in forty parts of boiling water. Forty grains in solution are neutralized with thirty grains of crystallized carbonate of soda; and when then precipitated with seventy grains of nitrate of lead, the liquid remains precipitable by more of the test.

TESTS, *Lond.* It is sparingly dissolved by water. It reddens litmus. At a red heat it is converted into carbonate of potash.

TARTARUM, *D.* *Impure Bitartrate of potash. Crude Tartar.*

FOR. NAMES.—*Fren.* Bitartrate de potasse; Crême de tartre.—*Ital.* Bitartrato di potassa.—*Ger.* Doppelt weinsaures kali; Weinstein.—*Russ.* Dvuvinnokisloe kali.

BITARTRATE OF POTASH (Cream of tartar, Supertartrate of potash, Purified tartar) must have been known in the impure state since the discovery of wine; but the pure salt was first prepared during the last century, and its constitution was unknown till the investigations of Scheele in 1769 (Geiger).

Chemical History.—This salt is all obtained from the crude tartar, argol, or winestone of commerce. This is a grayish or brownish obscurely crystalline substance, which concretes upon the inside of casks in which new wine has been kept. It is formed in largest quantity from the tart wines. This impure tartar (Crude tartar—Argol) consists of bitartrate of potash, tartrate of lime, colouring matter and other accidental impurities. It is freed in a great measure of these impregnations by dissolving and crystallizing it anew. The purest salt is obtained by dissolving what has been thus purified, evaporating gradually the solution, and removing the crust as fast as it forms upon the surface. Hence the vernacular name of Cream of tartar given to the pure salt. The crystals are best freed from lime by placing them in contact with diluted muriatic acid, afterwards draining and washing them (Duflos).

Bitartrate of potash is usually sold in the form of fine powder, but sometimes in fragments of white cakes with obscure crystallization on one of the surfaces. It has a sharp, agreeable, acid taste. It crystallizes in oblique rhombic prisms of very small size. Heat chars and decomposes it, leaving carbonate of potash, and disengaging empyreumatic oil, pyrotartaric acid, and various gases. When heated with half its weight of nitre, a mixture of carbon and carbonate of potash is obtained, which constitutes the black flux of chemists. But if the proportion of nitre be doubled, nothing remains behind except carbonate of potash. It is soluble in ninety parts of temperate, and in fifteen of boiling, water. The solution, like the dry salt itself, has a strong, agreeable acid taste. If heated, it effervesces briskly with carbonate of potash. It is not easily decomposed by acids; on the contrary its acid will decompose many of the neutral potash salts, uniting with their base, and falling down in the form of crystalline or pulverulent bitartrate of potash. The solution of the bitartrate is decomposed by the salts of lime, and tartrate of lime falls in the form of a white powder. It is composed of two equivalents of acid, one of base and one of water ($2\bar{T} + KO + Aq.$); and consequently of 132.96 parts of tartaric acid, 47.15 of potash, and 9 of water.

Adulterations.—It is often adulterated with various white mineral and organic powders. The proofs of its freedom from these are its complete solubility in boiling water, and its decomposing power over nitrate of lead, as laid down in the formula of the Edinburgh College.

Actions and Uses.—Bitartrate of potash is an excellent laxative and a valuable diuretic. In the dose of half an ounce singly, or in that of two drachms along with other mild laxatives, it forms a brisk yet gentle purgative, which may be used for a variety of familiar purposes. In doses somewhat larger, it sometimes gives rise to severe and long-continued purging of watery stools; yet it seldom causes griping at the time, or debility and prostration afterwards. In doses somewhat less, its cathartic qualities disappear

and give place to a powerful diuretic action; on account of which it has lately been much employed in medical practice, especially in dropsies of all sorts. Few diuretics are more generally serviceable in dropsy than ninety grains or two drachms of bitartrate of potash, administered thrice a-day with a little water. It is often used as a laxative with sulphur. Some employ it in the form of electuary; but it is better given simply with water.—A solution, with or without sugar, makes an excellent drink for febrile disorders.

Its doses are, for a cathartic effect, dr. iv. ad dr. vi.; for its diuretic action, dr. ss. ad dr. iii. ter in dies.

POTASSA CUM CALCE, *E. L.* POTASSA CAUSTICA CUM CALCE, *D.* *A mixture of potash and lime.*

TESTS, *Lond.* Miscible with water; an acid then added causes no effervescence; not altogether soluble in alcohol.

PROCESS, *Edin. Dub.* Take any convenient quantity of Aqua Potassæ; evaporate it in a clean, covered, iron vessel to one-third (one-fourth, D.) its volume; add slaked Lime till the fluid has the consistence of firm pulp. Preserve the product in well-closed vessels.

PROCESS, *Lond.* Take of Hydrate of Potash, and of Lime, one ounce of each. Rub them together, and keep the mixture in a well-closed vessel.

THIS preparation, the COMMON CAUSTIC of last century (Vienna paste), is intended for a milder caustic than pure potash, which in other respects it closely resembles in action on the body. It is little used, and may be excluded from the Pharmacopœias.

It is intensely caustic and alkaline to the taste, not wholly soluble in water, unless the water be in very large proportion, and only in part soluble in rectified-spirit. When long or carelessly kept, it becomes partially carbonated; and then it effervesces more or less with acids,—which is not the case when it is well made and recent. It is used in the same way and for the same purposes with the solid pure potash; but owing to its pulpiness, it is less convenient. I do not know what advantage there is in the dry, pulverulent preparation of the London College.

POTASSAE CARBONAS, *E. L.* POTASSAE CARBONAS E LIXIVO CINERE, *D.* *Carbonate of potash not quite pure, obtained by lixiviating, evaporating, and granulating, by fusion and refrigeration, the potashes of commerce.*

TESTS, *Edin.* One hundred grains lose not more than twenty on exposure to a red heat; and when dissolved and supersaturated by pure nitric acid, the solution gives a faint haze only with solution of nitrate of baryta, and is entirely precipitated by 100 minims of Solution of nitrate of silver (See *Tests* in *Introduction.*)

TESTS, *Lond.* Deliquescent; almost entirely soluble in water; it renders turmeric brown: when supersaturated with nitric acid, carbonate of soda and chloride of barium do not cause any precipitate, and nitrate of silver little. One hundred parts lose sixteen of water by a strong heat, and twenty-six of carbonic acid when treated with diluted sulphuric acid.

PROCESS, *Lond.* Take of Impure Carbonate of potash, 2 pounds; Distilled water, a pint and a half. Dissolve the salt in the water, and filter; pour the solution into a proper vessel, and evaporate it till it becomes

thick; then stir it constantly with a spatula while it concretes.

Carbonate of potash may be obtained more pure from crystals of Bicarbonate of potash heated to redness.

PROCESS, *Dub.* Take of
Potashes in coarse powder, and of
Cold water, equal parts.
Triturate them together; macerate for a week, stirring occasionally; filter and evaporate in a clean silver or iron vessel, stirring constantly towards the end with an iron spatula. Put the coarse powder thus obtained into close vessels. Should the potashes be very impure, roast them in a crucible till they are white, before they are dissolved in the water.

POTASSAE CARBONAS IMPURA, *L.* LIXIVUS CINIS, *D.* *Impure Carbonate of potash: Potashes: Pearlash.*

POTASSAE CARBONAS PURUM, *E.* POTASSAE CARBONAS, *L.* POTASSAE CARBONAS E TARTARI CRYSTALLIS, *D.* *Carbonate of potash.*

TESTS, *Edin.* It does not lose weight at a low red heat: and a solution supersaturated with pure nitric acid is precipitated either faintly or not at all, by solution of nitrate of baryta or nitrate of silver.

TESTS, *Lond.* The same as given under Potassæ Carbonas.

PROCESS, *Edin.* Pure Carbonate of Potash may be most readily obtained by heating crystallized Bicarbonate of potash to redness in a crucible; but more cheaply by dissolving Bitartrate of potash in thirty parts of boiling water, separating and washing the crystals which form on cooling, heating these in a loosely-covered crucible to redness so long as fumes are discharged, breaking down the mass and roasting it in an open crucible for two hours, with occasional stirring, lixiviating the product with distilled water, filtering the solution thus obtained, evaporating the solution to dryness, granulating the salt towards the close by brisk agitation, and heating the granular salt nearly to redness. The product of either process must be kept in well-closed vessels.

PROCESS, *Dub.* This process is essentially the same with the second of those in the Edinburgh formula, except that the preliminary crystallization of the bitartrate is dispensed with.

POTASSAE CARBONATIS LIQUOR, L. POT. CARB. AQUA, D.

PROCESS, *Lond. Dub.* Take of
Carbonate of potash, twenty ounces, L. (one part, D.);
Distilled water, a pint, L., (two parts, D.)
Dissolve and filter. (Density, 1320, D.)

FOR. NAMES.—*Potassæ Carbonas impurum*, sive *Lixivum Cinis.*—*Fren.* Potasse de commerce.—*Ital.* Potassa; Potassa di cenere; Potassa di peccia.—*Span.* Potasa.—*Ger.* Rohe Potasche.—*Dut.* Potasch.—*Swed.* Pottaska.—*Dan.* Potaske.—*Russ.* Potash.—*Tam.*, Marra ooppoo.—*Beng.* Jhar ke nemuk.
Potassæ Carbonas purum.—*Fren.* Carbonate de potasse.—*Ital.* Carbonato di potassa.—*Ger.* Kohlensaures kali.—*Russ.* Uglekisloe kali.

CARBONATE OF POTASH has been known from a period anterior to any scientific records.

There is considerable confusion as to the nomenclature of the several forms recognised by the Pharmacopœias. The London and Dublin Colleges recognise,—the former under the name of Impure Carbonate of potash, the latter under the classical name of *Lixivus cinis,*—the very impure carbonate obtained by simple lixiviation of vegetable ashes, and called in commerce Potashes. This article is excluded by the new Edinburgh Pharmacopœia, because it is not put to any medicinal use, and for pharmaceutic purposes is purified on the large scale by the manufacturing chemist, so that it is rarely seen in the crude state in the shops of

retailing druggists. The generic term, Carbonate of Potash, is attached by the Edinburgh College to this purified article; and the Dublin College defines it more minutely, by indicating its source in its title,—*e lixivo cinere.* The London College applies the simple term, Carbonate of potash, both to purified potashes and likewise to a much purer salt obtained by heating the bicarbonate. Finally, for this last variety, as obtained both from the bicarbonate and the bitartrate of potash,—and which is required only for certain pharmaceutic operations, and not for medicinal use,—the Edinburgh College affixes the supplementary term, Pure, and the Dublin College the explanatory term, *e tartari crystallis.* These differences are obviously immaterial as regards prescriptions; but they must be attended to in using the several carbonates in pharmacy or in chemical researches. Great care must be taken not to confound the Carbonate of the present Edinburgh Pharmacopœia with the Carbonate of the last Latin edition, the former salt being a corrosive poison, and the latter the bicarbonate, which is not poisonous.

Chemical History.—Carbonate of potash in an impure state is obtained in large quantity from land plants by drying them, burning them so as to consume their carbonaceous matter, lixiviating the ashes with water till they are exhausted, and evaporating the solution to dryness in iron vessels. The residuum is a deliquescent porous mass, presenting various tints of gray, blue, and green, known by the name of Potashes, and containing, besides carbonate of potash, a large proportion of sulphates, muriates, and other impurities. The quantity of potashes obtained from different plants varies exceedingly. Kirwan found that herbaceous plants yield more than woody plants, and that the barks of woody plants yield more than their woods; that the quantity of saline matter produced by lixiviating their ashes varies from 6 per cent to seventy-five per cent; and that worm-wood and fumitory among herbaceous plants, and beech among trees, yield the largest quantity observed in the course of his experiments. The following table, compiled from various sources, shows the quantity of pure potassa produced from one thousand parts of various plants.

Pine,	0.45	Barley-straw,	5.8
Poplar,	0.75	Beech-bark,	6.0
Trefoil.	0.75	Fern,	6.26
Beech,	1.45	Rushes, large,	7.22
Oak,	1.53	Maize-stalks,	17.5
Box,	2.26	Anthemis cotula,	19.6
Willow,	2.85	Bean-stalks,	20.0
Elm,	3.9	Sunflower-stalks,	20.0
Maple,	3.9	Common-nettle,	25.03
Wheat-straw,	3.9	Vetch,	27.5
Oak-twig bark,	4.2	Thistles, full grown,	35.37
Thistles,	5.0	Wheat-stalks, young,	47.0
Flax,	5.0	Worm-wood,	73.0
Rushes,	5.08	Fumitory,	79.0
Vine-shoots,	5.5		

Different varieties of potashes are imported into this country

chiefly from North-America and Russia. When potashes are exposed to heat and air in a reverberatory furnace, a part of their impurities undergoes oxidation, some water is given off, and a purer substance is produced which is called Pearl-ash in commerce. When the process of lixiviation is combined with the use of quicklime, and the application of a strong fusing heat, a substance is obtained of stony hardness, and much more caustic than either potashes or pearl-ash. This is called American ash or American potashes; and it is distinguished by a considerable part of its potash being in the caustic state. Vauquelin made a careful analysis of various specimens of the different articles here described, and found that the pure hydrated potash existing in the free state, or combined with carbonic acid, amounted in American-ash to 74 per cent, in Russian potashes to 67.0, in American pearl-ash to 65.5, and in various other European specimens to between 38.5 and 62 per cent.

From the potashes or pearl-ash of commerce is obtained by solution and evaporation the CARBONATE OF POTASH of the Edinburgh and London Pharmacopœias, the *Carbonas potassæ e lixivo cinere* of that of Dublin. The London and Dublin processes consist essentially in dissolving the impure salt in as small a quantity of water as possible, by which many of the impurities are left behind,—then evaporating the solution in very clean iron-vessels, till it is so concentrated as to become solid on cooling,—and stirring it briskly while it concretes, so that the salt is eventually obtained in small, roundish grains, rather larger than millet-seed. In this state it is often sold under the name of Purified Pearl-ash.

When thus far purified, carbonate of potash is white, opaque, caustic and alkaline to the taste, very deliquescent, and possessed substantially of all the properties to be described presently under the head of the pure carbonate. But in addition to these, it loses weight by a heat somewhat short of redness, owing to the presence of water, generally to the amount of twenty per cent. This impurity arises from the process of concentration being stopped before complete dryness. Farther, when saturated with nitric acid, its solution yields a precipitate both to nitrate of baryta and nitrate of silver, especially the latter, on account of the presence of some sulphate and muriate of potash.

PURE CARBONATE OF POTASH is sometimes obtained, as the London College directs, by subjecting the bicarbonate to heat; which drives off an equivalent of water and an equivalent of carbonic acid. If the bicarbonate be used in the crystalline form, more especially if it have been crystallized more than once, an extremely pure carbonate is thus readily prepared. Considering how little use is made in Pharmacy of a carbonate chemically pure, this process might perhaps have been sufficient for the Colleges. As it is comparatively expensive however, the Dublin and Edinburgh Colleges have introduced the older process, which consists in first charring and then incinerating the bitartrate of potash, previously purified by

solution and crystallization if necessary,—next lixiviating the residuum, which consists of carbonate of potash with a little charcoal, —and finally obtaining the salt by evaporation, granulation, and subsequent thorough drying.

Pure carbonate of potash is in small roundish grains, white, opaque, caustic and alkaline to the taste, and soapy to the touch, if moist. It quickly deliquesces in the air and soon becomes liquid; but in consequence of the slow absorption of carbonic acid from the atmosphere and its passage to the state of bicarbonate, it again very gradually dries up. A red heat fuses it; but no elevation of temperature, however great, causes any farther change. It dissolves in its own weight of water, occasioning heat in the act of solution. From a very strong solution of the density 1600 it may be crystallized, though with difficulty, by slow cooling, in opaque, rhombic octaëdres and tables, which contain two equivalents of water of crystallization. It is insoluble in alcohol. Its watery solution, which is admitted into the Pharmacopœias of London and Dublin, is a very powerful and extensively useful agent in Pharmacy as well as in chemical analysis; but for the former of these purposes the purified pearl-ash answers in general equally well. It decomposes, with the phenomena of double decomposition, the salts of lime, baryta, magnesia, and strontia,—throwing down insoluble white carbonates. It acts similarly on most of the salts of the ordinary metals; the precipitates from which however are commonly coloured. In the case of the salts of alumina and of the sesquioxide of iron, the precipitate is the hydrated oxide and not the carbonate; for these oxides do not unite with carbonic acid. It corrodes and dissolves the soft animal solids and many vegetable tissues, but not so energetically as the solution of pure potash.—— Carbonate of potash is distinguished from the bicarbonate, in the solid state by deliquescing in the air, and in solution by yielding a white precipitate with sulphate of magnesia, and a brownish-red one with corrosive sublimate; for neither of these reagents will affect the bicarbonate if in a state of diluted solution. From carbonate of soda it is known by its deliquescent property in the solid state, the soda salt being efflorescent,—and in solution by giving a yellow precipitate with chloride of platinum, and a granular or crystalline precipitate with an excess of tartaric or perchloric acid. Carbonate of soda in solution is not affected by any of these tests. It is composed of one equivalent of acid and one of base ($CO^2 + KO$), and therefore of 22.12 parts of carbonic acid, and 47.15 of potash.

Adulterations.—The adulterations of the common carbonate of potash are indicated by the Edinburgh College as being an excess of moisture, and too much sulphate or muriate of potash. If the specimen be of good quality, a red heat ought not to diminish its weight more than twenty per cent; and when its solution is supersaturated by pure nitric acid, solution of nitrate of baryta should occasion little more than a haze; while solution of nitrate of silver

of the strength of one part in forty, when added in the quantity of 100 minims for every hundred grains of carbonate, should leave no muriate in the fluid, so that an additional quantity of the silver test added after filtration has no farther effect. I have found that most samples of purified pearl-ash answer to these characters. The silver test indicates that there is not more than one grain per cent of muriate of potash present in the carbonate. The characters given by the London College are partly intended to indicate its nature, partly to detect its adulterations. The latter characters are inferior in precision to those of the Edinburgh Pharmacopœia. The quantity of pure salt in commercial carbonate may be conveniently estimated by its power of neutralizing tartaric acid. Five parts of real carbonate saturate 5.44 parts of acid gently dried, so as not to expel any of its water of crystallization (Wittstein).——The great quantity of moisture in the common carbonate of the shops, which is not generally adverted to in chemical or pharmaceutic works, must be carefully remembered and made allowance for in all operations in pharmacy.

The adulterations of the pure carbonate are with water, sulphate of potash, muriate of potash, and silica. Few specimens sold as pure carbonate are without some water. It is detected by the loss of weight at a red heat. The foreign salts occur in consequence of purified pearl-ash being substituted for the pure carbonate. They are detected by the solution, when supersaturated with nitric acid, giving a white precipitate with nitrate of baryta in the case of the sulphate of potash, and with nitrate of silver in the case of the muriate. These are the adulterations referred to by the tests of the Edinburgh College. Silica,—also sometimes present, owing to original admixture, or accidental impregnation from the salt having been long kept in the moist or dissolved state in crown-glass bottles,—may be discovered by a cloudiness or fleecy precipitate forming, on nitric acid being added to neutralization. The tests of the London College for this salt are vague, in consequence of the College having confounded under the same name, both that which is perfectly pure, and that which is obtained by purifying the potashes of commerce.

Actions and Uses.—All the forms of carbonate of potash here treated of are identical in their actions. Like caustic potash, they are corrosive; and though less powerful than it, they are sufficiently so to be very energetic poisons. They occasion destruction of the mucous membrane of the fauces, gullet, stomach, and sometimes of the intestines,—indicated at first by violent burning pain, prostration and vomiting, which is sometimes bloody,—and afterwards, provided death does not ensue in a few days, by excessive emaciation, and constant irritability of the stomach and bowels. Sometimes membranous tubes are discharged from the rectum, and more frequently than in the case of other corrosives, symptoms of stricture of the gullet present themselves. The proper antidotes

are vinegar, lemon-juice, or fixed oil. An ounce has occasioned death; and less would undoubtedly suffice. In doses of a drachm or thereabouts, and somewhat diluted, carbonate of potash acts as an irritant. Its medicinal actions are nearly the same with those of the bicarbonate of this alkali, and of the two carbonates of soda. It is antacid, antilithic, and diuretic. As a diuretic it has been commonly preferred to the bicarbonate; but both of them are much inferior as such to other potash salts, especially the nitrate, acetate, and bitartrate. It should be given for this purpose thrice a-day. As an antacid it is less used now than the alkaline bicarbonates;—not that it is less efficacious, but simply because its strong alkaline taste renders it more disagreeable to take. In calculus of the bladder or kidney, as well as in gravel, it is of great service where the morbid secretion consists of lithic acid and the lithates. When the tendency to lithic discharge is great, about thirty-five grains should be given in the course of the day in divided doses. In phosphatic gravel, the bicarbonate is preferable, for reasons to be mentioned under the head of the bicarbonate of soda,—where a fuller account will be found of the actions and uses of alkalis as antilithic remedies. It may be here observed however, that many prefer the potash carbonates to those of soda for antilithic purposes, on the supposition that they are more energetic solvents. They are sometimes used in the way of injection into the bladder; in which case the carbonate is preferable to the bicarbonate. Both salts are most extensively used as pharmaceutic agents and chemical tests.

The doses and preparations of carbonate of potash are, *Carbonas potassæ*, E. L. D. gr. v. ad gr. xii. *Potassæ carbonatis liquor*, L. (*Aqua*, D.), fl.dr. ss. ad fl.dr. i.

POTASSA CAUSTICA, *D.* See *Potassa.*

POTASSAE CAUSTICAE AQUA, *D.* See *Potassæ Aqua.*

POTASSA CAUSTICA CUM CALCE, *D.* See *Potassa cum calce.*

POTASSAE CHLORAS, *L.* *Chlorate of Potash.*

Tests, *Lond.* Entirely soluble; and the solution is not affected by nitrate of silver. Fusible; and a higher heat expels oxygen, leaving chloride of potassium. A little sulphuric acid renders the crystals first yellow, and then red, and expels peroxide of chlorine.

Process. None.

No evidence has yet been published of such a nature as to entitle this salt to admission into the Pharmacopœias. It was distinguished from other salts for the first time by Berthollet in 1786; but had been previously prepared by Higgins.

Chemical History.—It is obtained by transmitting chlorine to saturation through a solution of fifteen parts of carbonate of potash in thirty-eight of cold water,—exposing the solution, with the salt which crystallizes in it, for a few days to the air, and agitating occasionally until the odour of chlorine passes off,—and then sepa-

rating the crystals, and recrystallizing them from twice their weight of boiling water. In this process a part of the potash is decomposed, and its oxygen unites with a part of the chlorine to form chloric acid. The acid unites with the remaining potash, while another portion of chlorine unites with the potassium of the decomposed potash to form chloride of potassium. Hence chloride of potassium is found in the mother-water from which the chlorate of potash, owing to its inferior solubility, had separated by crystallization. On the supposition that the chloride is dissolved in the form of hydrochlorate of potash, the chemical actions are easily understood on the principle of water being decomposed, instead of potash.

Chlorate of potash is usually in the form of colourless tabular crystals, four-sided or six-sided, of pearly lustre, permanent in the air, and of a cooling saline taste like that of nitre. Heat fuses it. If maintained for two hours at such an elevation as to produce only a slight discharge of gas, the fused mass again concretes, and is found to consist of chloride of potassium and perchlorate of potash,—a portion of the chloric acid having abstracted oxygen from the rest. A stronger heat drives off the whole oxygen both from the acid and the potash, and leaves only chloride of potassium. It enlivens the combustion of burning fuel like nitre; and when mingled with various inflammable substances, it imparts the property of deflagrating or exploding, when the mixture is struck or exposed to heat. It is soluble in two parts of boiling water, and in about twelve parts at 60°. It consists of one equivalent of chloric acid and one of potash ($ClO^5 + KO$); that is of 75.42 parts of chloric acid, and 47.15 parts of base.

Adulterations.—It is subject to be impregnated with chloride of potassium from faulty preparation. This will be detected as the London College points out, by nitrate of silver occasioning a white precipitate in its solution. The other characters given in the London Pharmacopœia are merely intended for ascertaining its nature. The effect of sulphuric acid in rendering the crystals first yellow, and then red, with the expulsion of the green gaseous peroxide of chlorine, is very characteristic.

Actions.—Chlorate of potash has been proposed as a calmative and refrigerant in pulmonary consumption; and Dr Stevens used it in malignant fevers and cholera for promoting the arterialization of the blood. It is said to moisten and clean the tongue (Copland). It has not, however, been currently adopted for these, or, so far as I know, for any other purposes, and I am not aware why the London College has made it officinal. I have tried the effects of seven-grain doses thrice a-day in phthisis, but could not observe any physiological or therapeutic action whatever.

POTASSAE HYDRAS, *L.* See *Potassa.*

POTASSAE HYDRIODAS, *D.* See *Potassii Iodidum.*

POTASSAE LIQUOR, *L.* See *Potassæ aqua.*

POTASSAE LIQUOR EFFERVESCENS, *L.* See *Potassæ Aqua Effervescens.*

POTASSAE NITRAS, *E. L. D.* *Nitrate of Potash.*

TESTS, *Edin.* Entirely soluble: its solution is not affected by solution of nitrate of baryta, and faintly, or not at all, by solution of nitrate of silver.

TESTS, *Lond.* Entirely soluble in distilled water: The solution is not affected by chloride of barium or nitrate of silver: Heat fuses it; and, when raised, expels oxygen; and the residuum gives nitrous vapours with sulphuric acid.

POTASSAE NITRAS PURIFICATUM, D.

PROCESS, *Dub.* Take of
Nitrate of potash, one part;
Dissolve it in two parts of boiling water, and set the solution aside to cool and crystallize.

FOR. NAMES.—*Fren.* Nitrate de potasse; Nitre; Salpêtre.—*Ital.* Nitrato di potassa; Nitro; Salnitro.—*Span.* Salitre nitro.—*Port.* Nitro.—*Ger.* Salpetersaures kali; Salpeter.—*Dut.* Salpeter.—*Swed.* Saltpeter.—*Dan.* Saltpeter.—*Russ.* Azotnokisloe kali; Selitra.—*Arab.* Ubkir.—*Pers.* Shorah.—*Tam.* Potti-looppoo.—*Beng.* Shorah.—*Hind.* Bajee.

NITRATE OF POTASH (Nitre, Saltpetre, Sal-prunelle) has been known from remote antiquity; but in ancient times it was not accurately distinguished from other salts which form by efflorescence on the surface of the soil, more especially from carbonate of soda.

Chemical History.—It exists naturally in some soils, and may also be formed artificially. The greater proportion of what is used in Britain is obtained in various parts of the East Indies by lixiviating certain kinds of soil. An essential part of the composition of such soils is, that they shall contain decomposing felspar, mica, or other destructible minerals which consist partly of potash. The production of nitre from them is promoted by the presence of animal matter, but may also go on without it; so that the nitric acid must be formed through the intervention of atmospheric air. The soluble salts of the nitre soils consist of sulphates, muriates, and nitrates of potash, lime, and soda. The whole nitrates are converted into nitrate of potash by lixiviating the soil over a filter of wood-ashes containing carbonate of potash, and then duly evaporating the filtered liquor (Stevenson, Journ. Asiat. Soc. of Bengal, ii.). The crystalline matter thus obtained has a dirty yellowish hue; it contains much foreign matter technically called "refraction," and is known in commerce by the name of Crude Nitre or Crude Saltpetre. This is purified in various degrees, both in India and after importation into Britain, by repeated crystallization. Nitrate of potash is likewise prepared in many parts of Europe from soils artificially impregnated with animal matter,—or from the mortar of old buildings, especially of the under-ground floor,—or from artificial composts consisting of animal substances, decaying vegetables, ashes, and chalk, marl or lime. The nitrate thus in the first place produced is the nitrate of lime, which is converted into the nitrate of potash by double decomposition with carbonate of

potash; and the salt is then obtained by lixiviation, and purified as above by repeatedly crystallizing it.

Nitrate of potash, as now usually found in the shops, is a salt of considerable purity. It forms fragments of crystals of considerable size, which are striated, opaque, colourless, six-sided prisms, terminated by one, two, or six converging planes. It has a peculiar, cool, saline taste. It is permanent in the air. Heat fuses it, and when raised to redness drives off oxygen, and converts it into hyponitrite of potash. When thrown upon burning fuel, it enlivens greatly the combustion, causing deflagration. When allowed to cool from a state of fusion, it concretes into a hard, fibrous, opaque, white mass, known in commerce by the name of Sal-prunelle. This substance was at one time thought to differ from the crystals, or Saltpetre, in containing no combined water. The two forms, however, are identical in constitution, there being no water of crystallization in either. It is soluble in less than half its weight of boiling water, and in about four parts at 60°. It occasions considerable cold in the act of dissolving. It is composed of one equivalent of each of its constituents (NO^5+KO), and therefore of 54.15 parts of acid, and 47.15 of potash. It is sparingly soluble in rectified-spirit.

Adulterations.—Its adulterations, as indicated by the tests of the Edinburgh and London Pharmacopœias, are with sulphate of potash and muriate of potash. The former, in good nitre, as now often met with in the shops, is scanty or even altogether wanting. It is detected by solution of nitrate of baryta, occasioning a white precipitate. Muriate of potash is always present more or less, and is discovered by nitrate of silver causing a white precipitate of chloride of silver. Lime, which occurs only in the inferior sorts, and has not been provided for by the College formulas, is detected by solution of oxalate of ammonia throwing down the white oxalate of lime. The process of purification recommended by the Dublin College is now seldom necessary, as the salt of commerce is pure enough for most medical purposes. In order to obtain pure nitric acid however, it must be crystallized once or oftener, till nitrate of silver ceases to affect its solution in distilled water.

Actions and Uses.—The actions of nitrate of potash are chiefly fourfold,—irritant, cathartic, refrigerant, and diuretic. When swallowed in a state of solution, in doses between half an ounce and two ounces, it occasions heat and pain in the stomach, vomiting, excessive nervous depression, and sinking of the pulse. It has thus proved fatal in a few hours; but its poisonous effects are uncertain, for I have known an ounce retained for fifteen minutes without occasioning any inconvenience except a few attacks of vomiting. In less doses it is cathartic, but uncertain as such; and it is therefore never used in medicine as a purgative. Its refrigerant action, generally admitted by systematic writers on Materia Medica and by many practitioners, is of doubtful existence,—

having probably been inferred rather from the coldness it occasions while dissolving in water, than from actual evidence of its effects in disease. The sedative action ascribed by some to it has been probably inferred from its supposed refrigerant property, and not from observation. Like some other saline bodies it enjoys some reputation as a remedy in serous inflammations and articular rheumatism. Its diuretic action is the most undoubted of its medicinal properties, and has led to the extensive employment of it in dropsy. It is conceived by some to be best adapted for the treatment of ascites among dropsies. My own observation leads me to consider it as greatly inferior to other saline diuretics, and very uncertain in its operation in ascites, the disease in which it has been most recommended. It may be given either in powder with sugar, or in solution with syrup and some aromatic distilled water.

Its doses are: gr. x. ad gr. xx. as a sedative refrigerant; and scr. ii. ad dr. i. as a diuretic.

POTASSAE ET SODAE TARTRAS, *E. D.* SODAE POTASSIO-TARTRAS, *L.* *Tartrate of potash and soda.*

TESTS, *Edin.* Entirely and easily soluble in five parts of boiling water; muriatic acid occasions a crystalline precipitate in a strong solution: 37 grains in solution are not entirely precipitated by 43 grains of nitrate of lead.

TESTS, *Lond.* The salt is entirely soluble; the solution does not affect litmus or turmeric, and is not affected by chloride of barium or nitrate of silver: Sulphuric acid converts part into bitartrate of potash.

PROCESS, *Edin. Lond. Dub.* Take of
Bitartrate of potash, in powder, sixteen ounces, (seven parts, D.);
Carbonate of soda, twelve ounces (five parts, D.);
Boiling water, four pints (fifty parts, D.)
Dissolve the carbonate in the water; add the bitartrate (to neutralization, E.); boil and filter. Concentrate the liquor till a pellicle forms on its surface, and then set it aside to cool and crystallize. The residual liquor will yield more crystals by farther concentration and cooling.

FOR. NAMES.—*Fren.* Tartrate de potasse et de soude; Sel de Seignette.—*Ital.* Tartrato di potassa et di soda; Sal di Seignette.—*Ger.* Weinsaures natronkali; Seignettesalz.

THE London College, in attempting to shorten the pharmaceutic name of this salt, have chosen one involving a doctrine as to the constitution of the salt, which no chemist has hitherto advocated (see *Antimonium Tartarizatum*).

The TARTRATE OF POTASH AND SODA was discovered in 1672, and long secretly prepared by Seignette, an apothecary of Rochelle; whence it is still commonly called Rochelle-salt and sometimes Seignette's salt. Geoffroy discovered the mode of preparing it in 1731.

Chemical History.—It has been prepared in various ways; but it is now universally made in Britain, according to the College process, by neutralizing bitartrate of potash with carbonate of soda. There is an advantage in having a slight excess of the carbonate, notwithstanding the directions of the Edinburgh Pharmacopœia to observe exact neutralization.

It is met with in the shops in beautiful, colourless, and nearly transparent crystals, which are prisms or halves of prisms, presenting, six, eight or ten sides, and whose primitive form is the right rhombic prism. It has a mild, saline, not disagreeable taste. It is permanent in the air, except that it effloresces slightly when the air is very dry. Heat causes it to fuse in its water of crystallization, and when elevated, occasions decomposition, producing charcoal and carbonates of its two alkaline bases. Temperate water dissolves it in the proportion of two parts and a-half to one of salt; and at 212° it is much more soluble. The strong acids, such as sulphuric or muriatic acid, decompose the solution, appropriating the soda, and causing a crystalline precipitate of bitartrate of potash, if the solution be not too diluted. It is composed of one equivalent of tartrate of potash, one equivalent of tartrate of soda, and eight equivalents of water ($2\bar{T} + KO + NaO + 8 Aq.$); and therefore of 132.96 parts of acid, 47.15 of potash, 31.3 of soda, and 72 of water.

Adulterations.—As tartrate of potash and soda is almost always sold in crystals, it is little exposed to adulteration. The Edinburgh formula of tests is chiefly intended to meet the admixture of tartrate of lime and bitartrate of potash; both of which are left behind on dissolving the salt in a small quantity of boiling water. The nitrate of lead applied to a solution of a given quantity, according to the method directed in the formula, will show the presence of a due proportion of tartaric acid, and consequently the absence of the mineral acids in the form of salts. For the latter purpose the London College indicates the want of precipitation with chloride of barium and nitrate of silver; but these tests precipitate tartaric acid in the form of tartrate of silver and tartrate of baryta, unless the solution be considerably diluted; so that the London formula requires correction. One part of pure salt dissolved in ten parts of water is precipitated by both nitrate of baryta and nitrate of silver, if added in sufficient quantity.

Actions and Uses.—This salt is only known and used as a laxative. It is exceedingly convenient as such, both because very effectual, and because it has a less disagreeable taste than most efficacious purgatives among the neutral salts. It is administered in solution in eight or ten parts of water. A drachm added to one of the papers for effervescing powders increases their purgative power and constitutes what are incorrectly called Seidlitz (Seignette's?) powders in the shops. See *Sodæ bicarbonas*.

The dose of *Tartras potassæ et sodæ* varies from dr. ii. to dr. x.

POTASSAE SULPHAS, *E. L. D.* *Sulphate of potash.*

TESTS, *Edin.* Not subject to adulteration.

TESTS, *Lond.* Not soluble in alcohol, sparingly so in distilled water: chloride of pla-

tinum occasions in the solution a yellow precipitate, and chloride of barium a white one insoluble in nitric acid.

PROCESS, *Edin.* Take of
The residuum of the preparation of pure nitric acid, two pounds;
Boiling water, two gallons;
White marble, in powder, a sufficiency.
Dissolve the salt in the water; add the marble gradually till effervescence ceases and the solution is completely neutralized; filter the liquor and evaporate it till a pellicle forms on its surface; then set it aside to cool and form crystals.

PROCESS, *Lond.* Take of
The residuum of the preparation of nitric acid, two pounds;
Boiling water, two gallons.
Expel the excess of acid by heating the salt in a crucible; boil what remains in the water till a pellicle forms; filter the solution, set it aside for crystallization, pour off the liquor, and dry the crystals.

PROCESS, *Dub.* Dissolve in a sufficiency of boiling water the salt left after the distillation of nitric acid. Saturate the excess of acid with carbonate of potash; filter and evaporate, with a very gentle heat till the salt crystallizes.

PULVIS SALINUS COMPOSITUS, E.

PROCESS, *Edin.* Take of
Pure muriate of soda, and
Sulphate of magnesia, of each 4 ounces;
Sulphate of potash, three ounces;
Dry the salts separately with a gentle heat, and pulverise each, then triturate them well together, and preserve the mixture in well-closed vessels.

FOR. NAMES.—*Fren.* Sulphate de potasse.—*Ital.* Solfato di potassa.—*Ger.* Schwefelsaures kali.—*Russ.* Sernokisloe kali.

SULPHATE OF POTASH (Sulphate of Kali, Vitriolated tartar, Sal-polychrest of Glaser, Sal-de-duobus, &c.) occurs in volcanic regions and in the juices of plants; but what is used in medicine is all prepared artificially. The process for making it was first discovered by Croll about the middle of the seventeenth century.

Chemical History.—The Colleges direct it to be prepared from the residuum of the manufacture of nitric acid. The first step is to neutralize or remove the excess of sulphuric acid, of which, along with neutral sulphate of potash, that residuum is composed. The Dublin College saves the excess of acid by neutralizing it with carbonate of potash; which is comparatively expensive in relation to the value of the product. The London College more economically expels the acid by heat; and the Edinburgh College with equal economy neutralizes the excess with marble. The subsequent part of the process is the same in all the formulas, being simply the evaporation and crystallization of the neutral sulphate.

Sulphate of potash occurs in the shops under the form of small, but often well formed crystals, whose primary form is the right rhombic prism (Geiger), or rhombic octaëdre (Mitscherlich), but which generally are six-sided prisms terminated by six-sided pyramids. They are transparent, and colourless, very hard for a salt, of a bitterish, sharp, saline taste, and permanent in the air. Heat causes them to decrepitate slightly; a strong red heat fuses them; but no farther change occurs, however high the temperature may be raised. When heated with carbonaceous matter, the sulphate is deoxidised, and sulphuret of potassium formed. It is soluble in five parts of boiling water, and in sixteen parts at 60°. Its solution, acidulated with nitric acid, yields a white precipitate with the salts of baryta; and a solution not too diluted gives a yellow pre-

cipitate with chloride of platinum. These two characters distinguish it when dissolved from other neutral salts. It is insoluble in alcohol or rectified spirit. It is composed of an equivalent of each constituent, without any water of crystallization (SO^3 + KO); and hence it consists of 40.1 parts of acid, and 47.15 of alkali.

Adulterations.—It is so cheap and put to so little use in medicine or the arts, that it is scarcely subject to adulteration. The Edinburgh College has not given any tests of its purity; and those in the formula of the London College are mainly intended for ascertaining its nature, not for discovering adulterations.

Actions and Uses.—In action sulphate of potash is a mild cathartic, which has been supposed to act more permanently than other saline remedies of the class. Though now little employed, it is really a convenient laxative, and undeserving of the neglect into which it has fallen. In doses of one or two ounces however it is a powerful irritant, and has given rise to fatal accidents. It may be usefully combined with other saline laxatives, and forms a considerable part of a convenient compound cathartic of the kind, the *Pulvis salinus compositus*, E. Sulphate of potash being rather an insoluble salt, it should be given dissolved in warm water. On account of its great hardness and little tendency to absorb moisture from the air, it is an excellent substance for triturating with tough vegetable articles, to promote their thorough pulverization.

The doses of its preparations are: *Sulphas potassæ*, dr. i. ad dr. iv., according to the effect desired. *Pulvis salinus compositus*, E.

POTASSAE SULPHAS CUM SULPHURE, *E. Nature undetermined.*

PROCESS, *Edin.* Take
Nitrate of potash, and
Sulphur, equal parts of each.
Mix them thoroughly; throw the mixture in small successive portions into a red-hot crucible; and when the deflagration is over and the salt has cooled, reduce it to powder and preserve it in well closed bottles.

WHEN a mixture of sulphur and nitre is projected in small quantities at a time into a heated crucible, the sulphur burns with a blue flame and becomes oxidated at the expense of the nitric acid in the nitre. A grayish-white substance remains, whose nature has not been hitherto ascertained. It is much more soluble than sulphate of potash; and it crystallizes from a state of solution in rhombic prisms, the primitive form of that salt. Both the substance itself and its solution have a sulphureous odour; but sulphuretted-hydrogen is not disengaged on a strong acid being added; nor is sulphuret of lead thrown down by the salts of that metal. The salts of baryta cause a white precipitate insoluble in nitric acid, so that sulphate of potash is present.

In action it is a mild cathartic; and it was at one time much

used as a purgative, especially in cases of dyspepsia and chronic cutaneous eruptions, where frequent laxatives are required. It is given for these purposes in doses of thirty or sixty grains, commonly along with some other gentle laxative, such as bitartrate of potash. The bowels may often be very well regulated by a mixture of forty or sixty grains of the present preparation, and sixty or ninety of bitartrate of potash, taken in water before breakfast, and followed by gentle exercise.

POTASSAE TARTRAS, *E. L. D.* *Tartrate of Potash.*

TESTS, *Edin.* Entirely and easily soluble in four parts of boiling water: solution neutral, and it yields a crystalline precipitate with muriatic acid: Forty-four grains in solution are not entirely precipitated by 55 grains of nitrate of lead.
TESTS, *Lond.* Easily soluble: most acids separate from its solution crystals of bitartrate of potash, which chiefly adhere to the vessel. The precipitate occasioned by chloride of barium or acetate of lead is soluble in diluted nitric acid.

PROCESS, *Edin. Lond. Dub.* Take of
Bitartrate of potash in powder, three pounds (14 parts, D.);
Carbonate of potash, sixteen ounces (5 parts, D.);
Boiling water, six pints (15 parts, D.)
Dissolve the carbonate in the water; add the bitartrate till the liquor is neutralized; boil and filter. Concentrate the liquor till a pellicle form on its surface, and then set it aside to cool and crystallize. The residual liquor will yield more crystals by farther concentration and cooling.

FOR. NAMES.—*Fren.* Tartrate de potasse.—*Ital.* Tartrato di potassa.—*Ger.* Einfach weinsaures kali.—*Russ.* Vinnokisloe kali.

TARTRATE OF POTASH (Soluble tartar; *Sal vegetabile;* Tartarized kali) was known at least so early as the seventeenth century by the chemist Lemery.

Chemical History.—It is always obtained, as the Colleges direct, by adding bitartrate of potash to a hot solution of carbonate of potash, till exact neutralization is accomplished; after which some insoluble tartrate of lime is separated by filtration, and the liquor reduced by evaporation till it is sufficiently concentrated to crystallize on cooling.

It is sold commonly in the form of crystals, which are right rhombic prisms, or derived six-sided prisms, terminated by two converging planes. It is transparent and colourless, and has a mildly saline, bitterish taste. It becomes moist in damp air, but without deliquescing. At the temperature of 250° it gives off its water of crystallization without previously fusing, and becomes anhydrous. A higher heat decomposes it, producing carbonate of potash and charcoal. It is soluble in its own weight of water (Geiger); whence one of its old names, Soluble-tartar. The solution is precipitated by the salts of baryta, silver, and lead; white tartrates of the metallic oxides are thrown down; and these are redissolved on the addition of nitric acid. Sulphuric, nitric, muriatic, and many other acids, take to themselves a portion of the potash, and separate the rest in the form of bitartrate; which, according to the strength of the solution, forms quickly a sandy

precipitate, or slowly a crystallization adhering to the vessel. It is composed of one equivalent of acid, one of base, and two of water ($\bar{T}+KO+2$ Aq.); and therefore of 66.48 parts of tartaric acid, 47.15 of potash, and 18 of water.

Adulterations.—It is subject to adulteration with bitartrate of potash, but scarcely with any other substance. Its freedom from this impurity will be detected by the tests indicated by the Colleges,—its easy solubility, and the neutral state of the solution. The solvent power of nitric acid over the precipitates occasioned in its solution by chloride of barium and nitrate of silver, which is given among the tests of its purity by the London College, shows the absence of any sulphate or muriate. The application of nitrate of lead as a precipitant, in the manner stated in the Edinburgh formula, will prove whether or not the due proportion of tartaric acid be present, furnishing thereby a strong presumption of the purity or impurity of the salt in a general way.

Actions and Uses.—The neutral tartrate of potash is at present little used in medicine; but it is a very good laxative, like the other tartrates of the fixed alkalis. Its taste however is not so purely saline as that of the double tartrate of potash and soda, which it otherwise resembles closely in properties.

Its dose is dr. ii. ad dr. x.

POTASSII BROMIDUM, *L.* *Bromide of Potassium.*

TESTS, *Lond.* Entirely soluble: it does not affect litmus or turmeric, and is not affected by chloride of barium. Starch and sulphuric acid together turn it yellow. Its weight is not lessened by heat. Ten grains decompose 14.28 grains of nitrate of silver, precipitating a yellow bromide of silver, which is little affected by nitric acid, but is redissolved by ammonia.

PROCESS, *Lond.* Take of
Bromine, two ounces;
Carbonate of potash, two ounces and a drachm;
Iron filings, an ounce;
Distilled water, three pints.
Add the iron to a pint and a-half of the water, then the bromine, and stir frequently for half an hour. Apply a gentle heat, and when the colour becomes greenish, add the carbonate of potash previously dissolved in the rest of the water. Filter; wash the residue with two pints of boiling distilled water, and filter again; concentrate the united liquor for crystallization.

FOR. NAMES.—*Fren.* Bromure de potassium.—*Ger.* Bromkalium.—*Russ.* Bromistoi kali.

THE medicinal virtues of BROMIDE OF POTASSIUM are far from being so well established as to entitle it to a place in the Pharmacopœias.

Chemical History.—The process for preparing it given in the Pharmacopœia of London is that usually followed. This method,—which consists in combining bromine directly with iron in solution, and decomposing the dissolved hydrobromate of protoxide of iron by means of carbonate of potash,—is the exact counterpart of the process for preparing iodide of potassium.

Bromide of potassium crystallizes in cubes or rectangular four-

sided tables, of a pearly lustre, and of a sharp pungent taste, somewhat like that of common salt. It is permanent in the air, decrepitates when heated, and at a red heat fuses, without undergoing decomposition. It is very soluble in water, but sparingly so in alcohol. The watery solution is decomposed by sulphuric, muriatic, and nitric acids, as well as by chlorine; and bromine is disengaged, which colours the fluid brown. Nitrate of silver occasions a white precipitate, insoluble in weak ammonia. Acetate of lead, and the salts of protoxide of mercury also occasion a white precipitate. It is composed of one equivalent of each of its elements (K Br.), and consequently of 39.15 parts of potassium and 78.4 of bromine.

Adulterations.—The formula of tests given by the London College is partly intended for ascertaining the nature of the salt. The non-action of chloride of barium shows the absence of sulphates from its solution; but these are scarcely ever present. No test is given for the most common impurity, chloride of sodium. This cannot be detected without some trouble. It may be discovered by distilling the salt with an excess of bichromate of potash and sulphuric acid into a receiver containing strong Aqua ammoniæ. If no chloride be present, bromine alone passes over, and the ammonia is not coloured; if the salt contain chloride, chromate of the chloride of chrome also passes over, and tinges the ammonia yellow (Rose).

Actions and Uses.—Bromide of potassium is a diuretic and cathartic, and is conceived to be, like the preparations of iodine, a powerful deobstruent and alterative. It is on the last account only that it has been of late used in medical practice, and admitted into the London Pharmacopœia. In some trials by Dr Williams it seemed to manifest a remarkable influence as a deobstruent in enlargements of the spleen (Elements of Medicine). In scrofulous tumours and in bronchocele it has also been used with apparent advantage both internally and externally, and it has been used with success in syphilis as a substitute for the iodide of potassium (Ricord). If a poison at all, it seems not to be an energetic one; for a drachm produces only vomiting in dogs (Barthez in Pereira).

The dose of *Potassii bromidum* is from three to twelve grains thrice a-day. Externally it is used as an ointment with eight times its weight of lard.

POTASSII FERROCYANIDUM, *E. L.* *Ferrocyanide of potassium: Ferrocyanate of potash.*

TESTS, *Edin.* Not subject to adulteration.

TESTS, *Lond.* Entirely soluble. It loses 12.6 per cent of its weight with a gentle heat; it is decomposed by a strong heat; the residuum is soluble in hydrochloric acid, and precipitation is caused in this solution by ammonia; one hundred parts thus yield 18.7 of sesquioxide of iron. It feebly affects turmeric. It occasions a blue precipitate with the salts of sesquioxide of iron, and a white one with the salts of zinc.

FOR. NAMES.—*Fren.* Ferrocyanure de potassium; Cyanure de fer et de potas-

sium ; Prussiate de potasse ferrugineux ; Prussiate jaune de potasse.—*Ital.* Idroferrocyanato di perossido di ferro.—*Ger.* Kaliumeisencyanür ; Cyaneisenkalium ; Blutlaugensalz.—*Russ.* Geletsisto-sinerodistoi kali.

FERROCYANIDE OF POTASSIUM (Prussiate of potash ; Ferroprussiate of potash ; Ferrocyanate of potash ; Phlogisticated kali) was known in the beginning of last century.

Chemical History.—It may be obtained by boiling purified Prussian blue in solution of potash, till the blue colour disappears, filtering the liquor, concentrating it for crystallization, and crystallizing the product several times till it is rendered pure. It is prepared however in a different way on the great scale, for the use of the dyer and calico-printer. This method consists in projecting a mixture of pearl-ashes with hoofs, horns, and other animal matters, in the proportion of two to five, into a red-hot iron crucible, and stirring diligently the pasty mass thus formed, until fetid vapours cease to arise from it. When the product has cooled, it is lixiviated with cold water, filtered, and concentrated ; upon which yellow crystals of ferrocyanide of potassium are formed on cooling. These are purified by repeated crystallization (Ure). Another method followed in France consists in subjecting an intimate mixture of three parts of dried blood, one of nitre, and smithy-ashes in the proportion of one part for fifty of blood, to a low red heat till vapours cease to be disengaged, dissolving the product in twelve times its weight of water, concentrating the filtered liquor to the density of 1280, separating the fluid from the crystals of bicarbonate of potash which form on cooling, evaporating again to the density of 1300, and leaving the solution at rest for some days till the ferrocyanide of potassium crystallizes in its turn (Gaultier).

This salt occurs in commerce in broken or entire crystals of large size, whose form is commonly a rectangular prism truncated on the ends and edges, or a four-sided table derived from the rhombic octaëdre by excessive truncation of the apices. It is yellow, somewhat flexible, of a sweetish-bitter, saline taste, and permanent in the air. A gentle heat below 212° expels its water of crystallization, leaving a white anhydrous salt. A low red heat decomposes it, and converts it into cyanide of potassium, carburet of iron, and other compounds which have not yet been fully examined. It is soluble in four parts of temperate, and two parts of boiling, water ; but insoluble in alcohol. Its solution is a useful reagent in chemistry on account of the variously coloured precipitates it causes in solutions of metallic salts. It precipitates the salts of sesquioxide of iron deep-blue, of protoxide of iron white passing quickly to blue, of zinc and lead white, of copper chesnut-brown. Different views have been taken of its constitution. Some regard it as a compound of two equivalents of cyanide of potassium, and one equivalent of cyanide of iron, with three equivalents of water of crystallization ($2\ KCy + FeCy + 3\ Aq.$), and consequently of 39.15 parts of potassium, 79.17 cyanogen, 28 iron, and 27 water. According to

Liebig and Gregory, it is composed in the anhydrous state of two equivalents of potassium and one of a compound radicle, which is called ferrocyanogen, and consists of three equivalents of cyanogen and one of iron ($FeCy^3 + 2K$).

Adulterations.—The salt of commerce is remarkably pure. The testing formula of the London College presents a number of characters which chiefly indicate its nature. The Edinburgh College has not thought any tests necessary.

Uses.—Ferrocyanide of potassium is scarcely used in medicine, and, notwithstanding its apparent relationship to cyanogen and hydrocyanic acid, it is not poisonous. When swallowed it is absorbed, and passes off quickly with the urine. It is officinal chiefly as being the material from which hydrocyanic acid is most easily and cheaply prepared. It is the best reagent for detecting iron in solution: though there should be a mere trace only present, it occasions a blue precipitate. Dr Smart (U. S.) says he has found it a useful sedative and calmative in the febrile inflammations in doses varying from eight to fifteen grains; and he adds that too large doses cause giddiness, weakness, and sometimes ptyalism, red gums, and aphthæ of the mouth, without fetor.

POTASSII IODIDUM, *E. L.* POTASSAE HYDRIODAS, *D.* *Iodide of Potassium.*

Tests, *Edin.* Its solution is not affected, or is merely rendered hazy, by solution of nitrate of baryta: A solution of five grains in a fluidounce of distilled water, precipitated by an excess of solution of nitrate of silver, and then agitated in a bottle with a little Aqua ammoniæ, yields quickly by subsidence a clear supernatant liquid, which is not altered by an excess of nitric acid, or is rendered merely hazy.

Tests, *Lond.* Entirely soluble in water and in alcohol. It affects turmeric feebly or not at all, and does not affect litmus. Its weight is not diminished by heat. It is rendered blue by starch and sulphuric acid. Ten grains decompose 10.24 grains of nitrate of silver; and the precipitate is not altered by ammonia; but is partly dissolved, partly altered in appearance by nitric acid.

Process, *Edin.* Take of
Iodine (dry), five ounces;
Fine iron-wire, three ounces;
Water, four pints;
Carbonate of potash (dry), two ounces and six drachms.
With the water, iodine, and iron-wire prepare solution of iodide of iron as directed for *Ferri Iodidum.* Add immediately, while it is hot, the carbonate of potash previously dissolved in a few ounces of water, stir carefully, filter the product, and wash the powder on the filter with a little water. Concentrate the liquor at a temperature short of ebullition, till a dry salt be obtained; which is to be purified from a little red oxide of iron and other impurities by dissolving it in less than its own weight of boiling water, or still better, by boiling it in twice its weight of rectified spirit, filtering the solution, and setting it aside to crystallize. More crystals will be obtained by concentrating and cooling the residual liquor.

Process, *Lond.* Take of
Iodine, six ounces;
Carbonate of potash, four ounces;
Iron-filings, two ounces;
Distilled water, six pints.
Mix the iodine with four pints of the water, add the iron, and stir frequently for half an hour with a spatula. Apply a gentle heat until the liquid becomes greenish; add then the carbonate of potash dissolved in two pints of the water, and filter; wash the residuum with two pints of boiling distilled water, and filter again. Evaporate the mixed liquors to obtain crystals.

Process, *Dub.* Take of
Iodine, one part;
Sulphuret of iron, in coarse powder, five parts;

Sulphuric acid, seven parts;
Distilled-water, forty-eight parts;
Solution of carbonate of potash, a sufficiency;
Rectified spirit, six parts.
Triturate the iodine with sixteen parts of the water, and put the mixture in a glass-vessel. Pour upon the sulphuret in a mattrass the acid previously diluted with thirty-two parts of the water; and by means of a tube reaching to the bottom of the vessel containing the iodine, transmit the disengaged gas till the iodine disappear. Filter the liquor; concentrate it by boiling to an eighth, and filter again; add the solution of carbonate of potash gradually to saturation, namely till effervescence ceases; evaporate the fluid to dryness; dissolve the residual salt in the spirit with the aid of heat; decant the solution, evaporate to dryness, and keep what remains in a well-closed bottle.

UNGUENTUM HYDRIODATIS POTASSAE, D.

PROCESS, *Dub.* Take of
Hydriodate of potash, a scruple;
Axunge, an ounce;
Make them into an ointment.

UNGUENTUM IODINEI COMPOSITUM, L.

For this and other compound preparations of Iodide of potassium, see *Iodineum.*

FOR. NAMES.—*Fren.* Iodure de potassium; Hydriodate de potassae.—*Ital.* Ioduro di potassio.—*Ger.* Iodkalium.—*Russ.* Iodistoi kali.

THE IODIDE OF POTASSIUM (Hydriodate of potash) was first prepared soon after the discovery of iodine by Courtois in 1812.

Chemical History.—It may be obtained in a variety of ways; but whatever mode may be chosen, much care is required to produce a pure salt. On this account it is seldom met with in the shops perfectly pure, and sometimes contains a large proportion of foreign salts.

Of the numerous processes which have been lately proposed, three have been generally preferred to the rest. The first consists in converting iodine into hydriodic acid by a stream of sulphuretted hydrogen gas, saturating the acid by means of carbonate of potash, and then obtaining the iodide of potassium by evaporating the solution to dryness. In this process the iodine takes the hydrogen from the sulphuretted-hydrogen, and sulphur is thrown down. In the next step the hydriodic acid combines with the potash of the carbonate; or, as some think, iodide of potassium is formed, in consequence of the hydracid and metallic oxide reciprocally parting with hydrogen and oxygen to form water. Such is the process of the Dublin Pharmacopœia. Its disadvantages are,—that unless the iodine is kept in agitation, much gas escapes undecomposed, and the iodine is apt to be enveloped and rolled into masses by the disengaged sulphur. But the salt obtained is pure, if the manipulations be carried on with care. The Dublin College however is wrong in directing the evaporation to be conducted by ebullition; for at this temperature a little iodine is given off by the iodide, and carbonic acid is absorbed, so that carbonate of potash is mingled with the dry salt.——The second method consists in first making a mixture of iodide of potassium and iodate of potash by saturating a solution of caustic potash with iodine,—and then heating the residuum of evaporation to a red heat so as to convert the iodate into iodide. This method is disadvantageous,

inasmuch as caustic potash is an expensive material, and the whole manipulations require to be conducted with much nicety. The iodine should be added to the potash solution in slight excess; that is, so as to leave the fluid somewhat coloured. The potash must be completely caustic, otherwise the iodide will contain carbonate of potash. The ignition should be cautiously conducted at a low or cherry-red heat, and not higher, because iodide of potassium volatilizes at a full-red heat. The heat must be continued till bubbles cease to escape from the fused mass, for without this precaution some iodate will remain undecomposed.——The third process, which is that of the Edinburgh and London Pharmacopœias, and which has also been generally practised of late by manufacturers, commences with the formation of a solution of iodide of iron, as directed under that article (p. 428.) This salt is then decomposed by a solution of carbonate of potash,—the iron and potassium interchanging places, so that the carbonate of protoxide of iron falls down, and iodide of potassium comes into the solution. And the dry iodide is obtained in the usual way by evaporation. This appears a cheap and convenient method; but, like other processes, it will not yield a pure iodide without certain precautions. In the first place, both the iodine and the carbonate of potash must be quite dry and otherwise pure, or an allowance must be made for impurities. Secondly, iron-wire is preferable to iron-filings; for it is more pure, and, in consequence of being better diffused through the fluid, it undergoes solution more quickly. Thirdly, an excess of carbonate of potash should be avoided. Some indeed use an excess in order to precipitate the carbonate of iron thoroughly; but this is done to no purpose, for the carbonate is sufficiently soluble in water to pass in small quantity into the solution of iodide of potassium, during the washing of the precipitate on the filter. Fourthly, as this carbonate of iron occasions an admixture of sesquioxide of iron with the dry salt, a second solution and evaporation are necessary. Lastly, with all the care which can be taken, a little carbonate of potash is apt to be obtained in the end; and hence the second solution of the salt ought to be crystallized, and not evaporated to dryness. On the small scale it is convenient to use rectified-spirit for the second solution and crystallization. On the large scale water is employed as being a more economical menstruum; and any carbonate of potash remaining in the concentrated solution is converted into iodide of potassium before crystallization, by adding a little hydriodic acid prepared as described in the first of the present processes. ——The following new method, proposed by Pypers, seems to deserve attention on account of its simplicity and despatch. A mixture of one hundred grains of iodine, seventy-five of carbonate of potash, and two drachms of water, is triturated with thirty grains of iron-filings, until effervescence ceases; and the product is first gently dried and then ignited. Water forms with the saline mass

a colourless feebly alkaline solution, which yields a pure iodide of potassium by crystallization.——Whatever method be preferred, the evaporation of watery solutions of iodide of potassium should be conducted at a temperature a little below 212°, on account of the tendency of iodine to escape from the liquid when it boils.

Iodide of potassium when of good quality is sold in crystals or fragments of crystals, which are cubes or four-sided prisms, generally however showing a slight tendency to the rhombic form. They are colourless and opaque,—minute if obtained from rectified spirit, but sometimes an inch or more in length, if crystallized from water,—of a somewhat pearly lustre,—and of a sharpish saline taste. The salt has often a faint peculiar odour of iodine, and a pale yellowish tint, from a slight excess of that substance. It is permanent in dry air, slightly deliquescent in a moist atmosphere. A low red heat fuses, without decomposing it; and a full red heat volatilizes it. It is soluble in two-thirds of its weight of temperate water, and in still less at 212°. It is also very soluble in rectified-spirit, which at the boiling temperature takes up half its weight of the salt, and on cooling to 50° retains twenty-three per cent. From the former fluid spontaneous evaporation, and from the latter slow cooling, will furnish regular crystals. The watery solution, as well as the dry salt, is decomposed by nitric acid, and iodine is evolved. It possesses the property of dissolving iodine largely, and a dark reddish-brown fluid is formed, the officinal *Iodinei liquor compositus*, E. or *Liquor iodidi potassii compositus*, L. (see *Iodineum*, p. 551). A similar compound solution is obtained with rectified-spirit, constituting the officinal *Tinctura iodinei composita*, L. The simple solution in water yields with salts of lead a beautiful yellow precipitate, the iodide of lead. With corrosive sublimate a yellow precipitate is occasioned, which quickly passes to the splendid crimson-red biniodide of mercury. This precipitate is soluble in an excess both of iodide of potassium and of corrosive sublimate. An infusion of starch has no effect on a solution of pure iodide of potassium; but if it be decomposed by chlorine, or nitric acid, or sulphuric acid which contains nitrous acid, the disengaged iodine is at once indicated by a deep blue precipitate of iodide of starch. Iodide of potassium consists of one equivalent of each element (KI), and consequently of 126.3 parts of iodine, and 39.15 parts of potassium.

Adulterations.—It is exceedingly subject to adulteration, both from faulty manufacture, and from fraudulent admixture. The principal adulterations hitherto observed are with carbonate of potash, water, chloride of potassium or sodium, and iodate of potash. 1. Carbonate of potash is generally present to between one and five or even ten per cent, owing in all probability to errors in preparing the salt; but I have sometimes found 74.5 per cent of carbonate and 16 of water along with it, so that there was only 9.5 per cent of pure salt,—an amount of impurity, which can arise

only from fraud on the part of the maker. At one time most of the iodide of potassium used in Britain was of this composition. A proportion of five or ten per cent may be present without altering the crystallization or appearance of the salt; but the tendency to deliquesce is increased. A larger adulteration renders it granular and highly deliquescent. The existence of carbonate of potash is best detected by the action of nitrate of baryta on the solution, which yields an insoluble white precipitate of carbonate of baryta. Where the proportion of impurity is large, it may be both detected and removed by boiling the salt in three or four parts of rectified-spirit; for carbonate of potash is left at the bottom of the vessel, either in the form of a pasty mass, or completely dissolved in the water of the spirit in the form of a substratum. 2. Water is always present when carbonate of potash abounds, being retained by that salt during the process of drying. It may be detected by heating the iodide in a tube, upon which water will condense in the upper part of the tube. 3. Iodate of potash is only present as an accidental impurity, where the process followed in preparing the iodide is the second of those described above. It may be discovered by tartaric acid and starch solution striking a rich blue colour. Neither pure iodide of potassium, nor pure iodate of potash is thus affected; but if they be mixed, the blue colour is struck at once. 4. Chloride of potassium or sodium is the most frequent adulteration, next to carbonate of potash. It may be discovered through the comparatively easy solubility of chloride of silver in ammonia. With this view the Edinburgh Pharmacopœia directs a solution to be treated with an excess of nitrate of silver, and then agitated with solution of ammonia. Any chloride of silver thrown down by the nitrate is thus redissolved, while the iodide acquires great density by agitation, so as to subside quickly and leave a clear liquor above. In the clear fluid, nitric acid added to saturation of the ammonia, or in excess, will make the chloride of silver reappear in the form of a white precipitate; but if there was no alkaline chloride in the salt, the clearness of the fluid will scarcely be disturbed.

The object of the characters given by the Edinburgh and London Colleges for detecting adulterations, may be easily inferred from the preceding statements.

Actions and Uses.—The actions and uses of iodide of potassium have been made the object of numberless investigations during the last twenty years; but the results are discrepant. On the whole it seems to be an irritant in large doses, and in medicinal doses a diuretic, as well as to possess the property of exciting iodism, and of acting as a deobstruent and alterative. And the want of agreement among different observers has been probably owing, either to the salt being often much adulterated, or to its action being very liable, like that of mercury, to be modified by constitutional peculiarities. When applied to the skin, it produces some irritation.

When given internally, two or three drachms will kill a dog (Devergie), and one drachm a rabbit (Cogswell) in the course of a few days; and the symptoms are those of inflammation of the alimentary canal, attended with extreme depression. In like manner four grains thrice a-day have occasioned in the human subject sickness, colic, and diarrhœa (Cogswell, Hill); and one drachm has excited the same symptoms to a distressing degree (Wallace). Devergie even thinks that twenty grains might occasion death. On the contrary it is said, that thirty, sixty, and even one hundred and twenty grains have been given repeatedly within twenty-four hours (Wallace, Magendie, Buchanan),—nay, that six drachms have been swallowed in the same interval (Elliotson), without any unpleasant consequence resulting.

Iodide of potassium is a diuretic, though not an active one. When swallowed, it passes off quickly by the urine; in which it may accordingly be detected by chlorine and starch solution. When taken continuously for a length of time, it occasionally excites ptyalism, sometimes an affection like cold-in-the-head, sometimes catarrhal cough,—thus showing a tendency to act remotely as an irritant of the respiratory mucous membrane. Doubts have been entertained whether in the like circumstances it has the property, possessed by iodine, of inducing iodism. Though the current opinion would seem to deny to it any such power, I apprehend the real fact to be, that iodism may be induced by it in some constitutions easily enough, and sooner or later in most persons if sufficiently large doses be taken for an adequate length of time; but that its power in this respect is greatly inferior to that of iodine. At all events iodide of potassium has been known actually to excite disturbed digestion, a tendency to diarrhœa, emaciation, nervous irritability, tremors, and on one occasion even absorption of the mammæ (Hill, Wallace),—which are the leading features of iodism. Whether the alterative and deobstruent properties conceded by most observers to this salt depend or not upon its iodismal action, is a question which cannot at present be answered.

The special diseases in which iodide of potassium is used are the same with those formerly enumerated under the head of Iodine, to which article the reader is here referred. It has seemed most serviceable in goitre, strumous enlargement of the glands, strumous sores and eruptions, strumous ophthalmia, and secondary syphilis in scrofulous habits. Benefit has also been apparently derived from it in certain mammary tumours, enlargement of the liver, amenorrhœa, leucorrhœa, and ascites connected with hepatic disease. In most of these circumstances, however, it has been a common practice, which general experience has sanctioned, to combine free iodine with the iodide of potassium; so that it is not easy to know how much of the curative effects may have been owing to the one preparation, and how much to the other. No doubt can exist, that, whatever virtues may reside in the iodide, they are gene-

rally fortified by iodine. The simple iodide has seemed to me, as to many others, one of the best alterative remedies for mercurio-syphylitic sore-throat and eruptions, as well as for the *Cachexia mercurialis* generally.——When administered internally, it is given in the state of a diluted solution; and in consequence of its numerous chemical reactions with other bodies, as well as its slight taste, it is usually prescribed in the simplest possible shape. It ought not to be given along with the salts of the ordinary metals, because many of them decompose it, and produce insoluble iodides. It may likewise be administered externally, either in the form of simple ointment, as in that of the Dublin *Unguentum hydriodatis potassæ*, or still better with only eight times its weight of axunge, or in the form of bath. But its virtues as an external remedy are feeble unless when iodine is given along with it, as in the formulas for the London and Edinburgh ointments.

Its preparations and their doses are—*Potassii iodidum*, E. L. *Potassæ hydriodas*, D. gr. ii. ad gr. xx.? *Iodidi potassii liquor compositus*, L. fl.dr. ii. ad fl.unc. i. *Iodinei liquor compositus*, E. min. v. ad fl.dr. ss. *Iodinei tinctura composita*, L. min. x. ad. fl.dr. i. *Unguentum hydriodatis potassæ*, D. *Iodinei unguentum*, E. *Iodinei unguentum compositum*, L. for external use. For the processes for most of these preparations, see *Iodineum*.

POTASSII SULPHURETUM, *E. L.* POTASSAE SULPHURETUM, *D.* *A mixture of sulphate of potash with persulphuret of potassium.* *Sulphuret of potash.*

TESTS, *Lond.* Its fresh fracture is brownish-yellow. Its solution in water, as well as in most acids, emits an odour of hydrosulphuric acid. Its watery solution is yellow; and yields with acetate of lead a precipitate at first red, but afterwards black.

PROCESS, *Edin. Lond. Dub.* Take of
Sulphur, one ounce;
Carbonate of potash, four ounces.
Triturate them well together, and heat them in a covered crucible till they form a uniform fused mass (which when cold is to be broken to pieces and kept in well-closed bottles, *Edin.*)

POTASSAE SULPHURETI AQUA, L.

PROCESS, *Dub.* Take of
Washed sulphur, one part;
Solution of potash, eleven parts.
Boil for ten minutes; filter; and preserve the liquid in well-closed vessels. Its density is 1117.

Chemical History.—THIS preparation, modified by differences in the proportions of the materials used for making it, constitutes the Liver of sulphur of the older Pharmacopœias. There is some doubt both as to the nature of the officinal compound, and the accuracy of the process for preparing it. The view taken by many of its composition is, that it consists of protosulphuret of potassium and sulphate of potash, in the proportion of three equivalents of the former and one of the latter. Berzelius and Turner however consider, that in all varieties of liver of sulphur the sulphuret present is the tersulphuret of potassium; and that consequently complete chemical action cannot take place unless where the sulphur is in larger proportion than in the College formulas, namely in that

of 58 to 100 of carbonate, or ten equivalents of the former to four of the latter. According to the most recent investigation, the pharmaceutic preparation is a much more composite substance; for Winckler has found it to consist of 53.3 parts of tersulphuret of potassium, 29.5 hyposulphite of potash, 7 sulphite of potash, and also a little sulphate and carbonate.

Liver of sulphur has when fresh a liver-brown tint, a disagreeable, acrid, alkaline taste, but no odour till it is moistened, upon which a powerful odour of sulphuretted-hydrogen is disengaged. Under exposure to the air it gradually absorbs oxygen, and undergoes a series of changes, which end in the formation of sulphate of potash and free sulphur as the only constituents. It is soluble in water, to which it imparts a yellow colour and a strong sulphureous odour. The solution precipitates the salts of lead at first red, but soon afterwards black. The stronger acids decompose it, throwing down sulphur and disengaging sulphuretted-hydrogen gas.

It is subject to become altered through careless keeping; but is not liable to adulteration.

Actions and Uses.—In action it is an irritant and narcotic, producing in doses of a few drachms inflammation of the alimentary canal and tetanic spasms, which may prove quickly fatal. It is considered to be a good antipsoric remedy, both taken internally and applied externally; and its use has been extended from scabies to other chronic eruptions, especially lepra and psoriasis. In this country its employment internally has been altogether abandoned. In eruptive diseases it has been chiefly employed in the form of bath, consisting of one part of sulphuret to one thousand of water. The antidotal powers, once universally ascribed to it in most kinds of metallic poisoning, have been fully disproved by Orfila.

Its dose inwardly is gr. iii. ad gr. viii. in scabies, &c.

PRUNA, *E. L.* PRUNA GALLICA, *D.* *Dried fruit of Prunus domestica, L. W. DC. Spr.—Prunes.*

For. Names.—*Fren.* Pruneaux.—*Ital.* Prugna; Susina secca.—*Span.* Ciruelas Damascenas.—*Port.* Ameixas.—*Ger.* Pflaumen.—*Dut.* Gedroogde pruim.—*Dan.* Blommer. -*Russ.* Tschernosliv.

Figures of Prunus domestica in Nees von E. 319.—Hayne iv. 43.—Steph. and Ch. iii. 117.

It is thought by some that the modern Plum-tree is the Κοκκυμηλέα of Dioscorides; but according to others this was the *Prunus Cocumiglia* of Tenore, a very small species, which however may be merely a wild variety of the *P. domestica.*

Natural History.—The plum-tree belongs to the Linnæan class and order *Icosandria Monogynia*, and to the Natural family *Rosaceæ* of Decandolle and *Amygdaleæ* of Lindley. It is cultivated everywhere in the temperate regions of Europe; and in many parts of the continent, as well as in England, it is seen growing apparent-

ly wild; but its real native country is Syria, especially near Damascus. It flowers in April and May before the leaves are developed; and the fruit, which is a drupa, ripens from August to October. Long cultivation has multiplied exceedingly its varieties. The fruit, dried in the sun or with artificial heat, constitutes the Prune, or French-plum, of the grocer. This differs much in size, colour, sweetness and aroma, according to the variety of plum from which it is prepared. Those most esteemed for the dessert are the pale, sweet, high-flavoured kinds; but that used in medicine is dark, less sweet, and somewhat austere. Prunes of all sorts are largely imported into Britain from Bordeaux. Medicinal prunes are said to be obtained from the Small-Damascus-plum (Mérat), or from the St Julien-plum (Pereira), the fruit of the *Prunus domestica, var. γ. Juliana*, of Decandolle.

Chemical History.—The fresh ripe fruit contains about twenty per cent of solid matter; of which 11.5 are sugar, nearly 5 gum, and the rest malic and pectic acids, albumen, and digestible ligneous fibre (Berard). The proportion of sugar is probably increased in the prune by the process of drying; but the change has not yet been accurately investigated. The branches of the tree, and also the fruit, often exude a gum resembling cherry-gum and containing a large proportion of bassorin. The kernel of the fruit, like the seeds of the rest of this natural family, yields by distillation with water a poisonous hydrocyanated oil, identical or nearly so with that of the bitter almond.

Actions.—Plums are nutritive and refrigerant; but, in common with other stone-fruit, are apt to disorder the stomach and bowels, if eaten freely or not quite ripe. They become more digestible when converted into prunes; which constitute an agreeable and light article of diet for convalescence and in chronic diseases. With some people, when taken habitually in the evening, they tend to move the bowels in the morning. The only use to which they are applied in the Pharmacopœias of the Colleges is in preparing the *Electuarium Sennæ*, or Lenitive electuary; but they might be extensively used for similar purposes.

PRUNUS LAUROCERASUS. See *Laurocerasus.*

PTEROCARPUS, *E. L.* LIGNUM SANTALI RUBRI, *D.*

Wood of Pterocarpus santalinus, L. Suppl. W. DC. Spr.—Red-sandal-wood.

FOR. NAMES.—*Fren.* Santal rouge.—*Span.* Sandala rubio.—*Ger.* Rothes Santelholz.—*Swed.* Rödt sandelträdt.—*Arab.* Sundal ahmer.—*Pers.* Sundul soorkh.—*Tam.* Segapoo shandanum.—*Hind.* Ruckut chundun.

RED-SANDAL-WOOD, often also called Red-Saunders-wood, has been known in medicine since the time of the Arabian physicians. It is the wood of the *Pterocarpus santalinus*, a tall forest-tree, belonging to the Linnæan class and order *Diadelphia Decandria*,

and to the natural family *Leguminosæ*. It inhabits Ceylon and the mountains of the opposite Coromandel coast on the Indian continent. The wood is imported in billets, which are dense, heavy, dark-brown externally, and internally dark-red, variegated with lighter red rings. It is reduced with difficulty to powder, which is blood-red, of a faint, peculiar odour, and obscurely astringent to the taste. Its chief ingredient is about seventeen per cent of a peculiar resinoid principle, Santalin, $C^{16} H^{16} O^{3}$ (Pelletier). It is obtained either by rectified spirit and precipitation of the spirituous solution with water, or by ammonia and precipitation with an acid. It is insoluble in water, soluble in alcohol and ether, slightly soluble in volatile oils, readily soluble without decomposition in alkalis, and also soluble in acetic acid. The last solution is somewhat astringent to the taste, and is precipitated by solution of gelatin. These various solutions are blood-red or purple, but santalin is originally yellow and becomes red from the action of the air. The wood when heated exudes a red resinous-like matter, somewhat resembling Dragon's-blood (Geiger) and which is probably santalin.

This wood was at one time prized as a dye-stuff, but is now not much used in this country, though still a staple article in the Eastern art of dyeing. The only use made of it in medicine is for imparting a red colour to the *Spiritus lavandulæ compositus*.

PULEGIUM, *E.* See *Mentha.*

PYRETHRUM, *Root of Anacyclus Pyrethrum, DC. (Edin.)*;—*of Anthemis Pyrethrum, L. W.—(Lond. Dub.) Pellitory of Spain.*

FOR. NAMES.—*Fren.* Pyrèthre.—*Ital.* Pilatro; Piretro.—*Span.* Pelitre.—*Port.* Pyretro.—*Ger.* Bertramwurzel.—*Dut.* Tandwortel.—*Swed.* Bertramsrot.—*Dan.* Spytteurt.—*Arab.* and *Beng.* Akkurkurha.—*Tam.* Akkarakarum.

FIGURES of Anacyclus officinarum in Hayne, ix. 46.—Anthemis pyrethrum in Nees von E. 244.—Steph. and Ch. iii. 97.

THIS root has been used in medicine since the time of Dioscorides, by whom it was called Πύρεθρον.

Natural History.—There is some uncertainty as to its botanical source. Linnæus described the plant as a species of *Anthemis*, with a perennial root and several prostrate stems, inhabiting Arabia, Syria, France, Italy, Germany and other parts of Europe. Decandolle removed it into a new genus chiefly on account of a difference in the structure of its seeds, and called it *Anacyclus Pyrethrum.* Hayne, however, ascertained from genuine plants growing in Thuringia, where it is much cultivated, that the true medicinal root proceeds from a species, which, besides other differences, has an annual fusiform root and an erect branchy stem, and which he therefore established as a distinct species under the name of *Anacyclus officinarum.* He considers the species *Anthemis* (or *Anacy-*

clus) *Pyrethrum* to be vaguely determined; but the specimen of it in Willdenow's herbarium seemed to correspond with his new species. It belongs to the Linnæan class and order *Syngenesia superflua*, and to the Natural family *Compositæ* of Decandolle, or *Asteraceæ* of Lindley.

The pellitory-root of English commerce is usually brought from the Levant; but none has been imported since 1836 (Pereira). It is in pieces towards four inches long and a third of an inch thick, externally brown, mottled with black shining spots, and internally somewhat resinous-like. It has no odour; but when chewed, it produces a peculiar sense of heat, pungency and tingling in the mouth, which lasts for some time, and is attended with a copious flow of saliva. The expressed juice of the fresh root is not acrid.

Chemical History.—Alcohol and ether dissolve out the active ingredient of the dried root. This has been supposed to be an acrid fixed oil (Gaultier), or an acrid resin (Parisel), or to be attached equally to a resin, a fixed oil, and a volatile oil (Koene). As both Hagen and Schönwald have obtained from it a scentless volatile oil, possessing the peculiar taste of the root, it is probable that this is the active principle, and that it adheres with force to the resin and fixed oil. The root consists otherwise chiefly of inulin and ligneous fibre, with a little tannin, gum, and various salts.

Actions.—Pellitory-root has been used immemorially, but is now chiefly employed in domestic practice, as a masticatory for relieving toothache and neuralgia of the face, or as a stimulant gargle in relaxed sore-throat and paralysis of the tongue. A strong tincture is still used by some dentists (Duncan). Dioscorides used an oleaginous preparation of it as a stimulant embrocation in palsy; and the active principle in the form of tincture makes a good rubefacient. The native doctors of Hindostan give it inwardly in palsy (Ainslie); a practice which has been also followed in Europe.

PYROLA, *E. D.* CHIMAPHILA, *L.* *Herb of Chimaphila umbellata, Nuttal's Gen.—Spr.* (*Edin.*);—*of Chimaphila corymbosa, Pursh Fl. Amer. Sept.* (*Lond.*);—*of Pyrola umbellata, Linn.* (*Dub.*) *Pyrola.*

DECOCTUM PYROLÆ, D. DECOCTUM CHIMAPHILÆ, L.

PROCESS, *Lond. Dub*, Take of Chimaphila (Pyrola, D.) an ounce; Distilled water, a pint and a half (water, two pints, old wine measure, D.) Macerate for six hours, take out the pyrola, bruise and replace it in the water, D.); boil down to a pint (old wine measure, D.) and strain.

Pyrola umbellata figured in Hayne, xiii. 13.

THIS is a native North-American remedy, which in 1803 was introduced into medical practice by Dr Mitchell of the United States, and afterwards to the notice of European practitioners by Dr Somerville of Chelsea-Hospital.

Natural and Chemical History.—It is the herb or leaves of a beautiful little plant belonging to the Linnæan class and order *De-*

candria Monogynia, and to the Natural family *Ericineæ* of Decandolle or *Pyrolaceæ* of Lindley. Linnæus called it *Pyrola umbellata*; but the best authorities, following Pursh and Nuttall, consider it to present different generic characters, and term it *Chimaphila umbellata* or *corymbosa*. Its native name is Ipsissewa; and the inhabitants of the United States call it Winter-green, on account of its evergreen leaves. It grows in mossy turf under shady woods throughout North America, in central Europe, and in Siberia. It has a creeping root-stock,—a stem towards six inches high,—glossy, dark-green, coriaceous, wedge-shaped, serrated leaves,—and an umbelliform cluster of drooping bell-shaped, odoriferous, white flowers dotted with red points, which blow in July and August. The leaves have a bitter astringent taste, and a peculiar odour if bruised while fresh, but none when dried. Their bitterness and astringency are communicated to boiling water, which is therefore used for the officinal preparation, the *Decoctum pyrolæ*, D. or *chimaphilæ*, L. This decoction becomes deep-green with sesquichloride of iron. An extract is also in use. The leaves contain a little tannin, resin, gum, and various salts, with much lignin and eighteen per cent of bitter extractive matter, in which its virtues are concentrated.

Actions and Uses.—The fresh plant is irritant, and acts as a rubefacient. It was introduced into medicine as a tonic and diuretic in scrofula and dropsy. It increases the flow of urine, and was therefore strongly recommended by Dr Somerville in dropsies connected with debility. As it has been said also to lessen the lithic acid in the urine, it has been proposed and employed as an antilithic in gravel. It has likewise some diaphoretic action. It has been supposed, like uva-ursi, to have a soothing astringent effect on the urinary organs in catarrh of the bladder, chronic gonorrhœa, and chronic diseases of the kidneys. Its alleged virtues in scrofula are doubtful. It has not come much into use in this country.

The dose of the *Decoctum pyrolæ* is fl.unc. i. ad fl.unc. iv.

QUASSIA, *E. L. D.* *Wood of Quassia excelsa* (Lond. Dubl.), *Wood chiefly of Picræna excelsa, Lindl. Fl. Med., and seldom of Quassia amara, L. Suppl. W. DC. Spr.* (Edin.) *Quassia.*

Extractum Quassiae, E.

Process, *Edin.* To be prepared from Quassia in the same way with extract of Liquorice-root.

Infusum Quassiae, E. L. D.

Process, *Edin. Lond. Dub.* Take of Quassia-chips, a scruple, D.; two scruples, L.; three, E. Boiling (distilled, L.) water a pint, E. L.; half a pint, old wine-measure, D. Infuse for two hours in a covered vessel, and strain.

Tinctura Quassiae, E. D.

Process, *Edin. Dub.* Take of Quassia-chips, ten drachms (saw-dust, D. an ounce.) Proof-spirit, two pints (old wine-measure, D.) Macerate for seven days, and then strain.

TINCTURA QUASSIAE, COMPOSITA, E.

PROCESS, *Edin.* Take of
Cardamom-seeds bruised, and Cochineal bruised, of each half an ounce.
Cinnamon in moderately-fine powder, and
Quassia-chips, of each six drachms ;
Raisins, seven ounces.
Proof-spirit, two pints.
Digest for seven days, strain the liquor, express strongly the residuum, and filter.
This tincture may be also made by percolation, as directed for Compound tincture of cardamom, provided the quassia be rasped or in powder.

FOR. NAMES.—*Fren.* Bois de quassi ; Bois de Surinam.—*Ital.* Quassia.—*Ger.* Bitterholz ; Quassienholz.—*Dan.* Vestindisk bittertræe ; Quassietræe.—*Russ.* Kvassia visocaia.

FIGURES of Quassia amara in Hayne, ix. 4.—Nees von E. 383—Steph. and Ch. iii. 172.—Picræna excelsa as Simaruba excelsa in Hayne, ix. 16.—Nees von E. 381.—As Quassia excelsa in Steph. and Ch. iii. 173.

ALTHOUGH met with in Europe somewhat earlier, QUASSIA-WOOD was first made distinctly known about the middle of last century by Linnæus, through information communicated to him in 1760 by an officer at Surinam of the name of Dahlberg. Linnæus named it after a negro called Quassi, who informed Dahlberg of its virtues, and used it at Surinam as a febrifuge. It came quickly into general use in Europe; and a drug termed Quassia has been ever since in great request. The wood however now in commerce under this designation is not the same with that first employed; but is obtained from a different plant inhabiting Jamaica.

Natural History.—The original quassia is the wood of a tall shrub, never above fifteen feet in height, and whose trunk seldom exceeds the thickness of a man's arm. This is the *Quassia amara* of Linnæus, a species of the Natural family *Simarubaceæ*, and belonging to the class and order *Decandria Monogynia*. It inhabits Surinam, Guiana and Colombia, and is cultivated as an ornamental plant, but not for commercial purposes, in Brazil and various West-Indian islands. It has elegant pinnated leaves, whose common leaf-stalk is winged; and it bears beautiful spikes of red flowers. Its wood is light, yet close and tough, pale yellowish-white, without odour, and of a pure intense bitter taste. The bark varies; being in one specimen, sent to me from St Thomas's, extremely thin, dense, brittle, wrinkled, and yellowish-green ; while in others, which I have from Jamaica, Trinidad, and St Vincent, it is fully a line thick, more spongy and tough, smooth, and light-gray. Its infusion is not altered by sesquichloride of iron. I have often tried to obtain this wood from wholesale dealers in London ; but none of the billets sent to me correspond with true Surinam quassia. Professor Lindley mentions on the authority of a friend who resided long at Surinam, that for thirty years past it has ceased to be exported from that place. In all probability therefore Surinam quassia never occurs now in English trade.

The quassia of the shops at present is the wood of a very different species of the same Natural family, the *Quassia excelsa* of Linnæus, *Simaruba excelsa* of Decandolle, Hayne, and Nees von Esenbeck, or *Picræna excelsa* of Lindley. This is a magnificent

forest-tree, towards a hundred feet in height, inhabiting the plains, but more especially the hills, of Jamaica and other West-Indian islands; where it is called Bitter-ash, from its resemblance to the ash of Europe, and the intense bitterness of its whole organization. Its leaves are pinnated, but without the winged petioles of the Surinam quassia; and its flowers are small and yellowish. Its wood is very tough, close in texture, yellower than Surinam quassia, and equally bitter. Its bark, which is occasionally imported, is sometimes rather thin, dark-brown, smooth, and traversed by reticulating lines, more commonly thick, grayish-brown, wrinkled and similarly reticulated. The wood is imported from Jamaica in billets, often as thick as a man's thigh, sometimes thicker than his body, and then sometimes split into quarters. The larger wood is cut up in Jamaica into floor-planks, for which purpose it is of great value on account of its tough close grain, and its complete immunity from the attacks of insects.

Chemical History.—Its bitterness is intense and pure, unattended either with astringency, acridity, or aroma. This property is removed by boiling water and by spirit; which are accordingly used for making the officinal *Infusum* and *Tinctura quassiæ*. Rectified-spirit is said to make a better tincture than the proof-spirit enjoined by the Pharmacopœias. A watery infusion made by percolation without heat yields when evaporated an excellent *Extractum quassiæ*, which has been lately adopted as a pharmaceutic form by the Edinburgh College. The infusion yields gray flocks with sesquichloride of iron. Quassia owes its bitterness to a crystalline principle discovered in 1837 by Wiggers. It is obtained by concentrating a decoction of the wood, agitating it when cold with lime occasionally for four-and-twenty hours, evaporating the filtered liquid to dryness, acting on the residuum with boiling rectified-spirit, and obtaining impure crystals by concentration and cooling, which may be afterwards purified by repeatedly crystallizing them from absolute alcohol, mixed with a little ether. Quassin, called by some Quassite, is intensely bitter, soluble in 200 parts of water, sparingly soluble in ether, freely soluble in alcohol, fusible and neutral. Its constitution is probably $C^{20} H^{12} O^{6}$ (Liebig). The discoverer does not state distinctly in which of the quassia-woods he obtained it. I have not succeeded with the true quassia.

Adulterations.—Quassia is sometimes adulterated with other woods. I have met with billets which were entirely free of bitterness, and resembled branches of the black poplar. The taste will easily detect such substitutions before the billets are cut into chips or rasped, but the detection is difficult afterwards.

Actions and Uses.—In action quassia is a tonic, febrifuge, stomachic, anthelmintic, and probably in some degree narcotic. It acts as a powerful narcotic poison on flies and other insects; the alcoholic extract kills small animals with obscure narcotic symptoms, when it is introduced into the cellular tissue; and the infusion is

thought by some to possess calmative effects on the nervous system in man. As a bitter tonic, it sometimes arrests intermittent and remittent fevers. In Brazil indeed it is in such estimation on this account as to be called Cayenne cinchona. It is also a useful tonic in debility during convalescence from prolonged acute or chronic diseases. Its most important application however is as a stomachic in dyspepsia connected with loss of tone in the stomach; in which it is given either singly or with antacids, such as bicarbonate of potash dissolved in its infusion to the extent of a scruple in two ounces. Its infusion is a good anthelmintic for ascarides, if administered in the way of injection. It preserves animal matters from decay, a property possessed more or less by all simple bitters. It is often used by brewers as a substitute for hops, although prohibited by severe statutes in this and other countries.

The doses of its preparations are *Pulvis quassiæ*, gr. xxx.—*Infusum quassiæ*, fl.unc. i. ad fl.unc. iii.—*Extractum quassiæ*, E gr. v. ad gr. xv.—*Tinctura quassiæ*, E. D. fluidr. i. ad fluidr. iv.—*Tinctura quassiæ composita*, E. fluidr. i. ad fluidr. iv.

QUASSIA SIMARUBA, *D.*—See *Simaruba.*

QUERCUS, *L.* QUERCUS CORTEX, *E. D.* *Bark of Quercus pedunculata, W. Spr.* (*Edin. Lond.*)—*of Quercus Robur, L.* (*Dub.*)

DECOCTUM QUERCUS, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of Oak-bark, ten (eight, D.) drachms; Water, two pints (old wine measure, D.) Boil down to one pint, and then strain.

EXTRACTUM QUERCUS, D.

PROCESS, *Dub.* To be prepared from Oak-bark in the same manner as extract of Gentian.

FOR. NAMES.—*Fren.* Chêne.—*Ital.* Quercia.—*Span.* Roble.—*Port.* Carvalho.—*Ger.* Eiche; Steineiche.—*Dut.* Eikenboom.—*Swed.* Ek.—*Dan.* Egetræe.—*Russ.* Dub obiknovennoi.

FIGURES of Quercus Robur in Hayne, vi. 35,—Nees von E. 92,—Quercus pedunculata in Hayne, vi. 36,—Nees von E. 93,—as Q. Robur in Steph. and Ch. iii. 151,—Engl. Bot. 1342.

OAK-BARK has been used as an astringent in medicine since the days of the Greek physicians. The tree is the Δρυς of Dioscorides.

Natural and Chemical History.—The bark is obtained from two species in this country, the *Quercus Robur* and *Q. pedunculata*; which differ from one another chiefly in the fruit being in the former sessile, and in the latter supported, several together, on a long peduncle. The genus belongs to the Linnæan class and order *Monœcia Polyandria*, and to the Natural family *Amentaceæ* of Decandolle and *Corylaceæ* of Lindley. The pedunculated species is that from which oak-bark is most commonly obtained in Britain. It is peeled in the spring from small branches. It has a greyish, shining epidermis, and is somewhat cinnamon-coloured on its inner surface. It is brittle, fibrous, without odour, and of a strongly

astringent taste. It gives out its astringency readily to water or rectified-spirit; and its watery decoction yields an astringent extract, which is officinal in the Dublin Pharmacopœia. Its solutions yield a dark bluish-black precipitate with the salts of sesquioxide of iron. According to Sir H. Davy it contains 15 or 16 per cent of tannin; and it is said to contain nearly thrice and a half as much in winter as in spring (Biggins in Pfaff). The acorns of the oak contain 38 per cent of starch, 9 tannin, 6.4 gum, 5.2 resin, 5.2 bitter extractive, and 4.3 concrete oil, besides various salts and ligneous fibre (Löwig).

Actions and Uses.—Oak-bark is a powerful astringent, and may be used for all the purposes to which vegetable astringents in general are applied. Its decoction is an excellent gargle for relaxed uvula and sore-throat, a good stimulating astringent lotion for ulcers with spongy granulations, and an astringent injection for leucorrhœa. Internally it may be employed in dysentery and chronic diarrhœa, in hæmorrhagies, and in chronic mucous discharges. Of late however it has been in a great measure abandoned, probably without reason, for astringents of foreign origin; and its applications are now almost confined to relaxed sore-throat and fluor albus, in which it is used topically. When employed as a gargle, a little sugar should be dissolved in the decoction; and sometimes one or two drachms of alum are added to every five ounces of the mixture.

The doses of its preparations are *Decoctum quercus*, fluidunc. i. ad fluidunc. iv.—*Extractum quercus*, D. gr. x. ad gr. xl.

QUERCUS INFECTORIA, *D.* See *Galla.*

QUINA, *L.* *Alkali obtained from the bark of Cinchona cordifolia.* *Quina.*

TESTS, *Lond.* Soluble very easily in alcohol, but not in water unless an acid be added. It alters the colour of turmeric, tastes bitter, and is entirely destroyed by heat.

QUINA (Quinina; Quinia; Quinine) is one of the alkaloidal proximate principles to which cinchona-bark owes it virtues as a tonic and febrifuge. It was discovered in 1820 by Pelletier and Caventou. Its chief source is Yellow Bark (see *Cinchona*).

Chemical History.—It is most easily obtained by decomposing a solution of the commercial sulphate of quina with ammonia. A sulphate of ammonia is formed, while the alkaloid, being little soluble in water, is precipitated in the form of a snow-white powder. It may also be prepared more directly from cinchona-bark by a variety of processes; but the easiest way to obtain it in a state of purity is to make a pure sulphate in the first instance.

In its ordinary state quina is a snow-white amorphous powder, but it may be got in needle-shaped crystals by slowly cooling a saturated solution in alcohol or water. It is without odour, but of an intense pure bitter taste, which, on account of its insolubility, is

slowly developed. It fuses about 300°, and if suddenly cooled puts on the appearance of a resin. It is very sparingly soluble in cold water, and dissolves in 200 parts at 212°. Ether dissolves it more readily, and rectified-spirit still more so. As precipitated from water, it is a hydrate; it parts with its combined water at a temperature below its melting point; and when afterwards thrown into water, it swells a little and returns to its hydrated condition. It is dissolved by most acids in their diluted state, neutralizes them, and forms either neutral salts or subsalts, which are for the most part crystallizable in delicate needles, and moderately soluble in water. They all possess the pure intense bitter taste of their base; and their solutions in water are precipitated by ammonia owing to the separation of quina, and are also precipitated by tincture of galls, from the formation of the insoluble tannate of quina. Quina has been often analyzed, and with various results, of which those obtained by Liebig are most confided in. He found it to consist of 74.4 per cent of carbon, 7.61 hydrogen, 9.88 oxygen, and 8.11 azote; which numbers correspond with 20 equivalents of carbon, 12 hydrogen, 2 oxygen, and 1 azote, or $C^{20}H^{12}O^{2}N$.

Quina is easily distinguished from cinchonia, the other alkaloid of cinchona-bark, by its form and taste. It is intensely bitter; and it is very rarely seen except in the form of amorphous powder, because it is crystallized with difficulty. Cinchonia on the other hand crystallizes from rectified-spirit with great facility in rhombic prisms of moderate size; and it is free of bitterness.

Actions.—The actions of quina are identical with those of its sulphate. I am not aware that it is ever used in medicine instead of that salt, or why the London College has introduced it into the list of the Materia Medica.

QUINÆ SULPHAS, *E.* QUINÆ DISULPHAS, *L.* QUINÆ SULPHAS, *D.* *Sulphate or Disulphate of Quina.*

TESTS, *Edin.* A solution of ten grains in a fluidounce of distilled water and two or three drops of sulphuric acid, if decomposed by a solution of half an ounce of carbonate of soda in two waters, and heated till the precipitate shrinks and fuses, yields on cooling a solid mass, which when dry weighs 7.4 grains, and in powder dissolves entirely in solution of oxalic acid.

TESTS, *Lond.* Entirely soluble in water, especially acidulated. Ammonia throws down quina; and the residue, on evaporating the liquid, ought not to taste of sugar. It loses 8 or 10 per cent of moisture when heated, is entirely destroyed by a red heat, and is turned green by the addition first of chlorine and then of ammonia.

PROCESS, *Edin.* Take of
Yellow-bark, in coarse powder, one pound;
Carbonate of soda, eight ounces;
Sulphuric acid, half a fluidounce;
Purified animal charcoal, two drachms;
Boil the bark for an hour in four pints of water, in which half the carbonate of soda has been dissolved; strain and express strongly through linen or calico; moisten the residuum with water and express again; and repeat this twice. Boil the residuum for half an hour with four pints of water and half the sulphuric acid; strain, express strongly, moisten with water, and express again. Boil the residuum with three pints of water, and a fourth part of the acid; strain and squeeze as before. Boil again the residuum with the same quantity of water and acid, strain and squeeze as before. Concentrate the whole acid liquids to about a pint; let the product cool; filter it; and dissolve in it the re-

mainder of the carbonate of soda. Collect the impure quina on a cloth, wash it slightly, and squeeze out the liquor with the hand. Break down the moist precipitate in a pint of distilled water, add nearly one fluidscruple of sulphuric acid, heat it to 212°, and stir occasionally. Should any precipitate retain its gray colour, and the liquid be neutral, add sulphuric acid drop by drop, stirring constantly till the gray colour disappears. If the liquid reddens litmus, neutralize it with a little carbonate of soda. Should crystals form on the surface, add boiling distilled water to dissolve them. Filter now through paper, preserving the funnel hot; set the liquid aside to crystallize; collect and squeeze the crystals; dissolve them in a pint of distilled water heated to 212°; digest the solution for fifteen minutes with the animal charcoal; filter, and crystallize as before. Dry the crystals with a heat not exceeding 140°.

The mother-liquors of each crystallization will yield a little more salt by concentration and cooling.

PROCESS, *Lond.* Take of

Cinchona cordifolia, bruised, 7 pounds;
Sulphuric acid, nine ounces;
Purified animal charcoal, two ounces;
Hydrated oxide of lead,
Solution of ammonia, and
Distilled water, a sufficiency.

Mix four ounces and two drachms of sulphuric acid with six gallons of distilled water, add the cinchona, boil for an hour, and strain. Boil the residue again in the same quantity of water and acid for an hour, and strain. Then boil the cinchona for three hours in eight gallons of distilled water, and strain. Wash the residue frequently with boiling distilled water. Mix the liquors and add to saturation the oxide of lead in the moist state. Pour off the supernatant fluid, and wash the precipitate with distilled water. Boil the liquors for fifteen minutes, strain, and add the solution of ammonia to precipitate the quina. Wash this till the water ceases to be alkaline. Saturate what remains with the sulphuric acid previously diluted, digest the solution with the animal charcoal, and strain. Finally, having washed the charcoal, cautiously concentrate the solution, to obtain crystals.

PROCESS, *Dub.* Take of

Yellow cinchona-bark, in coarse powder, four pounds;
Distilled water, eight (old wine) pints;
Diluted sulphuric acid, two ounces.

Digest them in a proper vessel, with a moderate heat and frequent stirring, for four hours, and strain. Digest the bark again with an equal quantity of water, and do this thrice. Add to the united liquors enough of fresh-burnt and slaked lime to saturate the acid. Dry on blotting-paper the precipitate which subsides. Digest this for six hours with three pints of rectified-spirit, and filter. Repeat this thrice, with an equal quantity of spirit. Distil the spirituous liquors to dryness with a vapour-bath heat. Add diluted sulphuric acid gradually to the residuum, till there is a very faint excess of acid; and obtain crystals by concentration and cooling.

FOR. NAMES.—*Fren.* Sulphate de quinine.—*Ital.* Solfato de quinina.—*Ger.* Schwefelsaures quinin.—*Russ.* Sernokisloi chinin.

SULPHATE OF QUINA was discovered at the same time with its base in 1820 by MM. Pelletier and Caventou. It came quickly into notice as a substitute for the drug from which it is obtained; and at present in this country, as well as in many parts of the continent, sulphate of quina has almost completely displaced cinchona-bark in regular practice.

Chemical History.—All the processes for preparing it consist substantially in exhausting yellow-bark of its bitterness by water acidulated with sulphuric or muriatic acid, decomposing the solution with some inorganic base, and combining the precipitate, which is impure quina, with sulphuric acid. The details of the various known methods differ exceedingly; but the main objects aimed at by all of them are to exhaust the bark readily, to avoid as much as possible the use of the expensive menstruum rectified-spirit, and to simplify the steps for purifying the quina or its sul-

phate. It is not decided by manufacturers which process answers best on the large scale, but from such trials as I have made it appears to me, that the best on the small scale,—inasmuch as it dispenses with the use of spirit altogether, and very readily yields a pure salt,—is that given in the new Edinburgh Pharmacopœia.

This process consists in first removing a great part of the colouring principles and resin of the bark, together with its proper acid, the cinchonic or kinic acid, by a boiling solution of carbonate of soda, then exhausting the residuum with very weak sulphuric acid, next decomposing the concentrated acid liquors with carbonate of soda, and lastly uniting the precipitated quina with sulphuric acid largely diluted with boiling water, and purifying the crystals obtained on cooling by a second crystallization from water after digestion with animal charcoal. If the minutiæ carefully stated in the Edinburgh formula be attentively followed, the acid liquor, when ready for decomposition by carbonate of soda, is not high-coloured, and two crystallizations of the sulphate are sufficient to render it a snow-white salt.——The London method,—in which the bark is exhausted at once by weak sulphuric acid, the acid liquors neutralized and decolorized by hydrated oxide of lead, and the impure quina separated by ammonia,—appears ingenious and simple in theory; but I have not found it to yield either so abundant or so pure a product as the mode recommended by the Edinburgh College. Much of the quina is lost unless the lead precipitate is washed much more perseveringly than the very loose directions of the College formula indicate.——The process of M. Henry long followed in France and in this country, and substantially adopted in the last Dublin Pharmacopœia,—but which labours under the disadvantage of requiring the use of rectified-spirit,—is to exhaust the bark by water containing sulphuric acid or muriatic acid, to decompose the acid liquors with milk of lime in slight excess, to collect the precipitate and dry it, to take up the quina from it with boiling rectified-spirit, to distil off the spirit, to neutralize the residuum with diluted sulphuric acid, and finally to purify the crystals by animal charcoal. The lime here used as a precipitant, not only throws down quina, but likewise forms with the colouring principles of cinchona a compound insoluble either in water or in spirit. In Britain the necessity of employing rectified spirit is an obstacle to this otherwise convenient and productive process.——Caustic soda, which has been recommended as a precipitant on the ground that it does not when in excess redissolve any of the quina, as the other precipitants are alleged to do (Calvert), was found by Dr Maclagan not to yield so abundant a product by the Edinburgh process as the carbonate of soda.——The mother liquors of all these processes yield chinoidine (vide Appendix).

The quantity of sulphate of quina obtained from yellow-bark varies greatly with its quality. Some specimens yield scarcely one per cent. Pfaff obtained at the rate of 34 ounces from 100 pounds;

which, if the *civil-pfund* is meant, will amount to a trifle above two per cent. A gentleman in London who manufactures it largely informed me a few years ago, that the extremes he obtained were 25 and 50 ounces from 100 pounds avoirdupois, that is, between 1½ and 3 per cent. Wittstein indicates from 1 to 3 per cent as the average product. A table showing the productiveness of different barks in the hands of various experimentalists will be found under the head of *Cinchona*. All other varieties of cinchona-bark yield greatly less than yellow-bark, and some of them render the process complex in consequence of also containing more or less cinchonia.

The commercial sulphate of quina, disulphate of chemists, is usually sold in the form of a loose mass of interlaced, filiform, silky crystals, of a snow-white colour, without odour, and of a pure, most intense, bitter taste. The crystals, when exposed to the air, lose three-fourths of their water of crystallization by efflorescence. They melt at about 240°, become red at a higher temperature, and at a red heat are charred and by degrees altogether dispersed. They dissolve in about 740 parts of temperate water, and in 30 parts at 212°; and the latter solution deposits numerous crystals on cooling. They are much more soluble when the water is acidulated with sulphuric acid. They dissolve in sixty parts of temperate rectified-spirit. The watery solution has a peculiar blue tint by reflected light, yields a white precipitate of quina with the alkalis or their carbonates, and a white precipitate of tannate of quina, with infusion of galls. When treated first with chlorine and then with ammonia, it acquires an emerald-green colour, and slowly deposits a copious green precipitate. The salt, when it retains its full amount of water of crystallization, consists of two equivalents of quina, one of sulphuric acid, and eight of water ($2C^{20}H^{12}O^{2}N + SO^{3}+8Aq$), that is, 74.3 per cent of base, 9.2 of acid, and 16.5 of water. Under this view of its composition it is evidently the disulphate of quina.

A neutral sulphate, sometimes incorrectly called bisulphate of quina, is obtained by adding to a concentrated boiling solution of the disulphate as much sulphuric acid as enters into its constitution. On concentrating the solution rhombic prisms are formed, consisting of one equivalent of base, one of acid, and eight of water, and which are soluble in their own water of crystallization at 212°, and in ten parts of water at 60°.

The commercial disulphate of quina being in great demand and of high price, it is much subject to adulteration. That manufactured in England is commonly purer than what is imported from France. The adulterations hitherto noticed are sulphate of lime, mannite or sugar, starch, margaric acid or some other crystalline fatty matter, sulphate of cinchonia, salicin, and caffeïn the active principle of coffee. The London formula of tests will detect some, but not all of these impurities. Sulphate of lime is indicated by

the salt not being entirely destructible by heat; fatty matters by its not being wholly soluble in acidulated water; and sugar or mannite by the sweet taste of the residuum left on evaporating the watery solution, after removing the quina by precipitation with ammonia and filtration. The other tests in the formula are rather for ascertaining the nature of the salt than for detecting impurities; and no account is taken of starch, cinchonia, salicin, or caffeïn as occasional adulterations.—The Edinburgh formula, instead of providing against any particular impurities, is intended to determine generally whether or not the salt is pure. The process consists in dissolving the salt in water acidulated with sulphuric acid, detaching the quina by an excess of carbonate of soda, and then weighing it; and for the last purpose the quina is collected by heating it in the solution from which it has been precipitated, till it contracts into a fused mass, so that it is obtained in a concrete cake when it cools. After being weighed, it is subjected to the action of solution of oxalic acid, which dissolves it entirely if pure, but not if sulphate of lime were present in the salt. I have found that ten grains of pure sulphate of quina give steadily 7.4 grains of quina, when treated according to this formula. Though sufficient for most impurities, it will not detect adulteration, where the foreign ingredient is caffeïn or sulphate of cinchonia.——Another convenient formula for testing sulphate of quina is the following. Twenty parts of boiling water acidulated with sulphuric acid dissolve it entirely and without any floating oily globules appearing, if there be no fatty matter present: The solution when cold does not become blue with tincture of iodine, if free of starch: It does not precipitate with oxalic acid, if free of lime: And when treated with solution of baryta so long as a precipitate forms, which precipitate is a mixture of quina and sulphate of baryta, the liquid has not a sweet taste, if free of sugar or mannite. Salicin is discovered by cold concentrated sulphuric acid forming with the suspected salt a red instead of a colourless solution. If this acid solution is brown or black, it indicates starch, sugar, fatty matters, or other organic substances [Wittstein]. Caffeïn is difficult to detect; but it is too dear in this country to be used for adulterating sulphate of quina, when that salt bears an average price. Sulphate of cinchonia is also troublesome to detect. Yet the adulteration is of importance; for it is supposed to be common, when, as at present, the pale barks are cheaper than yellow-bark. Probably the best method of discovering it is to dissolve the salt in forty parts of boiling water, which on cooling will deposit most of the sulphate of quina, but retain most of the salt of cinchonia; and by concentrating the residual solution, the latter is obtained in short rhombic prisms or pearly scales,—forms which are never assumed by sulphate of quina.

Actions and Uses.—Quina was one of the first substances in which the activity of a crude drug was clearly traced to an alka-

loidal crystalline principle. It possesses in a concentrated form the most important actions of cinchona-bark. It is seldom given except in the form of disulphate; so that it is unnecessary to treat under the present head of any other preparation except this salt.

The disulphate of quina is a tonic, and as such stands at the head of all vegetable remedies. By some, all its other physiological actions, as well as all its therapeutic effects, are held to depend on its tonic properties. But the most important of its therapeutic actions, its power of arresting certain periodic diseases, cannot be rationally referred to this head, and is therefore considered by many to be a specific effect, that is, a result incapable at present of being satisfactorily explained. Single small doses, not exceeding a few grains, have no particular obvious effect in the generality of people, except that each produces increase of appetite and improved digestion. But when frequently repeated in these doses, it strengthens the pulse, increases the muscular force, and invigorates the tone of the nervous system. These results are best observed in a state of debility, and are obscure in the healthy state of the body. In many after a time, and in some even from the first, small doses tend to induce headache, or sickness, or irregular action of the bowels; and these effects are almost certain to follow when gastro-enteric irritation pre-exists. Large doses, such as a scruple or half a drachm, have been observed to occasion sickness and pain in the stomach, giddiness, flushed countenance, palpitation, a sense of distension in the head, intense weighty headache, ringing in the ears, and sometimes vomiting, numbness in the feet, deafness, blindness, and delirium. Alarming symptoms and even death have been caused by its injudicious administration in larger quantities. The slighter nervous symptoms, such as giddiness and ringing in the ears, have been described under the name of Cinchonism, and their production has been thought, but on doubtful grounds, to be necessary for the full development of its therapeutic action (Blair). It is absorbed in the course of its action, and may be detected in the urine and sweat (Landerer). It possesses antiseptic properties over dead animal matter.

Some have thought that quina itself is less apt to disorder the stomach than its disulphate; some ascribe the same superiority to its phosphate or cinchonate; and others imagine that its activity as a therapeutic agent is increased in the form of neutral sulphate. There is no sound reason for any of these propositions. The disulphate, in relation to cinchona-bark, is a more powerful tonic, but is destitute of its astringent properties. It is much less apt to excite sickness and vomiting when given in large doses during periodic diseases, especially where the stomach is irritable. It possesses the same advantage likewise in most cases where it is given in small tonic doses; nevertheless some on the contrary maintain that it is more apt, especially than infusions of cinchona, to excite in small doses nausea, pain in the stomach, and febrile symptoms.

The special diseases in which it is chiefly employed are the following. In Intermittent fevers it is the most efficacious of all remedies. It is best given during the apyretic intermissions in divided doses, to the extent of between twelve and forty grains in all, according to the urgency of the particular case, and the violence of the disease in the particular locality or climate. If incidental irritation in the stomach be first removed by leeches, blisters, and opium, or by opium alone, acute local inflammation by general blood-letting, crudities in the alimentary canal by emetics and purgatives, and diarrhœa or dysentery by opium and laxatives or otherwise,—sulphate of quina very seldom fails to arrest intermittent fever before the second or third succeeding paroxysm; and not unfrequently it puts a sudden stop to the disease at its first administration. Violence of fever during the fit, or congestive enlargement of the liver or spleen, is not a contraindicant as some imagine. According to practitioners in hot climates, the greatest obstacle to its efficacy is unusual tendency to vomiting, or dysentery. General experience warrants the conclusion that sulphate of quina is superior as a febrifuge to cinchona-bark, inasmuch as it is more commonly retained by the stomach,—admits of being given in much larger quantity at once, so that a sufficiency may be administered in short apyretic intermissions,—cures a considerably larger proportion of cases,—and arrests the disease in general much more quickly. Nevertheless it is said that opposite results have been observed in some endemics (Hancock).——It is often not less useful in Remittent fever, provided the treatment be commenced in time, so long as the remissions are distinct. Dr Allan, now of Forres, has informed me, that a few years ago he found it effectual even in the dreadful remittents of Madagascar and the eastern coast of Africa, if it was given at once in large doses of thirty or forty grains at the first remission, more especially when the remission was well marked.——In Continued fever its utility is more circumscribed. The virtues once almost universally assigned to cinchona-bark as a tonic, antiseptic and febrifuge in the typhoid stage and form of continued fever, are now no longer confided in, and have never been transferred to sulphate of quina. But it is serviceable in certain circumstances. When distinct remissions occur, particularly in the fevers of childhood, and no obstacle exists from the presence of irritation in the stomach or intestines, sulphate of quina often proves almost as perfect a febrifuge as in ague. It is also of service in the typhus of adults when attended with exhausting non-critical sweats, which it sometimes arrests. It promotes convalescence when this is retarded by general nervous debility, and still more by defective appetite and feebleness of digestion. I have repeatedly seen it arrest relapse in inflammatory fever, when the relapse put on the intermittent character.——It is contraindicated in most acute local inflammations. In subacute Rheumatism however it is sometimes an effectual remedy; and Hay-

garth's treatment even of acute rheumatism with cinchona-bark has been practised also with sulphate of quina, apparently not without advantage.—The allied affection Neuralgia, when periodic and regular in its recurrence, may be generally treated with as much success by this remedy as ague itself, especially however that variety of it which affects the head. It is a most valuable stomachic tonic in dyspepsia depending upon enfeebled or depraved digestion; in which disorder it is usually given half an hour before meals, and has often extraordinary power in augmenting the appetite and promoting healthy chymification. In that form of dyspepsia however which is connected rather with unusual irritability of the stomach, it seems on the contrary to be hurtful by increasing irritation. Dyspepsia is one of the diseases in which it appears often disadvantageous to use this remedy long and continuously, on account of its tendency to occasion in fourteen days or three weeks headache and ineffective diarrhœa; and therefore an interval of a few days may be usefully interposed from time to time.—Lastly, in diseases at large connected with an enfeebled state of the system, and especially in debility attending convalescence from most acute and chronic diseases, it is the best of tonics, with the single exception perhaps of iron. Dr Pereira thinks it least useful as a tonic where debility occurs in connexion with chlorosis or impoverishment of the colouring globules of the blood, and that chalybeates are more appropriate in such circumstances,—an observation which is probably well founded.—Its utility in gangrene, or in the atonic form of erysipelas and some other inflammations in which cinchona-bark was once held to be an essential remedy, is greatly doubted by most practitioners of the present day.

Sulphate of quina is supposed to have the effect of promoting the action of certain other remedies. From the concurrent testimony of various physicians it seems to accelerate in a remarkable manner the constitutional action of mercurials. It has also been supposed by some to increase the activity of aloes as a purgative, and to lessen its griping tendency; but I have not been able to verify this observation. Its action as an adjuvant to other remedies deserves to be more studied.

The forms in which it is usually administered are that of pill and that of solution. The pill is best made with a little conserve of roses and bread-crumb. The solution is commonly made with the aid of a drop or two of sulphuric acid, to increase the solubility of the salt; and sometimes a little syrup is added to cover the bitter taste, which however is not unpleasant. The dose for dyspepsia, or as a general tonic, is one or two grains twice or thrice a-day. From twelve to eighteen grains divided into four or six doses will be generally sufficient for the ordinary intermittents of Europe; but the severe forms which occur in the south of Europe, and still more those of the tropics, require thirty-six or forty grains on an average; and in Madagascar Dr Allan informs me he had not un-

frequently to use ninety grains divided into three doses. Some think the solution acidulated with sulphuric acid the most efficacious form in tropical intermittents; others maintain that the efficacy of the salt is injured in this way, and is greatest in the formof pill (Madras Reports, 1831); whence it may be inferred to be very effectual in either mode. The doses in periodic neuralgia, which I have found sufficient for checking the disease abruptly, are twelve or fifteen grains divided into several doses.

Sulphate of quina is one of the remedies which may be administered for its constitutional action according to the Endermic method, that is, by applying it to the skin recently stripped of its cuticle by means of a blister. In this way so small a dose as six grains has cured violent ague,—even where the remedy had failed when given by the mouth (Cristin). It is said however to excite severe pain where it is applied, and sometimes violent inflammation and even sloughing.

Other salts of quina have been proposed as improvements upon the disulphate, such as the nitrate, muriate, phosphate, ferrocyanate, citrate, acetate, cinchonate, valerianate, and tannate. But there is no good reason for supposing that any one of them is superior in efficacy to the disulphate, or that it signifies much with what acid the alkaloid is united.

Its doses are, gr. i. to gr. ii. repeatedly as a tonic, and gr. iii. to scr. i. repeatedly as a febrifuge.

RESINA, *L.* See *Terebinthina.*

RANUNCULUS ACRIS, *D.* *Leaves of Ranunculus acris (L. W. DC. Spr.)*

RANUNCULUS FLAMMULA, *D.* *Leaves of Ranunculus Flammula (L. W. DC. Spr.)*

FOR NAMES.—*Fren.* Rénoncule.—*Ital.* Ranunculo.—*Span.* Ranunculo.—*Ger.* Hahnenfuss.

FIGURES of Ranunculus acris in Roque, 118.—Engl. Bot. 652.—Ranunculus Flammula in Roque, 118.—Engl. Bot. 387.

Natural and Chemical History.—THE genus RANUNCULUS (Butter-cup), which belongs to the Linnæan class and order Polyandria Polygynia, and gives its name to the Natural family in which it is arranged, comprises a great number of species, the common ornaments of our fields, moors, and ditches. They are distinguished from other similar genera by the inside of the base of each petal presenting a minute concave scale. Of the species admitted by the Dublin Pharmacopœia, the *R. acris* is very common in meadows, especially where somewhat moist, and near ditches. It is distinguished from *R. bulbosus* and *R. repens*, which considerably resemble it, by not presenting a bulbous root like the former, and by being smooth upon the flowering stem, not hairy, as is the case with

the latter. The *R. flammula* is equally common on moist hilly pastures and moorlands, and is easily known from all other species in the same localities by its smooth, elongated, ovato-lanceolate leaves. The leaves and unripe germens of both species are acrid, occasioning when chewed a singular intense cutting sensation in the point of the tongue, which quickly ceases when the plant is spit out. The acridity of these and all other species of Ranunculus which I have yet examined, is entirely lost by drying them, however carefully the process be managed; and it also disappears in the germens as the seeds, which are themselves bland, ripen. It however passes over in distillation and may be preserved in the distilled water for a considerable time.

The other species of Ranunculus, singularly enough, divide themselves into two groups in respect of this leading property of the genus. Some, such as *R. repens, aquatilis, Lingua* and *Ficaria,* among indigenous species, are perfectly bland at all seasons; others, such as *R. sceleratus, alpestris, bulbosus, gramineus,* are intensely acrid, as well as the two official species. According to my own frequent observation, the *R. acris* is far from being so energetic as to merit its specific name, and is often almost bland. *R. flammula* and *sceleratus* are well named; and nothing can surpass the instant and intense pungency of the green unripe germens of the latter. *R. bulbosus, gramineus,* and *alpestris* are less active than these last, but much more so than *R. acris.* I have not tried the other species said to be acrid.

In some of the species a crystalline principle has been indicated, which is neutral, volatile, and acrid; but though the designation of Ranunculin has been appropriated for it, its existence is not well established and its properties are little known. There is little doubt however that a very interesting active principle does exist throughout the genus. I have found in the green germens of *R. sceleratus* a crystalline principle, which volatilizes during trituration at the temperature of 60°, occasioning pungent smarting of the nostrils and eyes with a copious secretion of tears and mucus, and which in a close vessel at the same temperature rises and condenses in long acicular crystals. It appears to pass over unaltered by distillation with the water of the juice; and the distilled liquid is intensely acrid at first, but slowly loses that property, and deposits at the same time a large quantity of white flakes. The want of material prevented me from following out this inquiry.

Actions and Uses.—The acrid species of Ranunculus are endowed with great energy as poisons, insomuch that half an ounce of the juice of *R. sceleratus* will kill a dog (Krapf). The effects produced are those of irritation merely. The bruised leaves of several species constitute a prompt rubefaciant, and are sometimes used in domestic practice as such. They also excite vesication, or even ulcers, if left long applied; and are said to be employed by beggars for the latter purpose, as well as to keep sores open. The juice is

a powerful and immediate emetic. Withering maintains from frequent trials, that the distilled water of *R. Flammula* is superior in energy, quickness, and convenience to sulphate of zinc as an emetic. It seems difficult therefore to account for the indigenous species of Ranunculus having got so completely into disuse. The loss of virtue under desiccation, with the consequent impossibility of storing or preserving them, may be the cause,—a difficulty which may be obviated when their active principle is thoroughly known.

RHAMNUS, *L. D.* RHAMNI BACCÆ, *E.* *Fruit of Rhamnus catharticus, L. W. DC. Spr.* *Buckthorn.*

SYRUPUS RHAMNI.

PROCESS, *Edin. Lond.* Take of
Fresh juice of Buckthorn-berries, four pints;
Ginger sliced, and
Pimento bruised, of each six drachms;
Pure sugar, four pounds.
Let the juice rest three days; pour off the clear liquor, and strain it. Digest the pimento and ginger in a pint of the strained liquor at a gentle heat for four hours, and filter. Boil down the rest of the juice to a pint and a half; mix the two liquors, add the sugar and dissolve it with heat.

PROCESS, *Dub.* Take of
Fresh juice of buckthorn-berries, two (old wine) pints and a half;
Ginger sliced, and
Pimento-berries bruised, of each three drachms.
Let the juice rest till the sediment settle, and filter it. Add the ginger and pimento to ten ounces of the filtered juice; macerate for twenty-four hours, and strain. Boil down the residue to one (old wine) pint, and form the whole into a syrup.

FOR. NAMES.—*Fren.* Nerprun.—*Ital.* Prugnolino; Ranno.—*Span.* Ramno catartico; Espina cervina.—*Port.* Escambroeira.—*Ger.* Wegdorn; Kreutzdorn.—*Dut.* Wegedoorn.—*Swed.* Getappel.—*Dan.* Korsbaer; Vrietorn.—*Russ.* Pridoroschnaia igolka.

FIGURES of Rhamnus catharticus in Nees von. E. 360.—Hayne, v. 43.—Steph. and Ch. 119.—Engl. Bot. 1629.

BUCKTHORN is a very old article of the Materia Medica, and has been thought by some to be the Ῥαμνος of the Greeks; but the description in Dioscorides under that head does not apply well to the modern *Rhamnus catharticus*.

Natural History.—This is a branchy shrub about ten feet high, which is found in woods and hedges of this and other European countries. It belongs to the Linnæan class and order *Pentandria Monogynia*, and to the Natural family *Rhamnaceæ* or *Frangulaceæ*. In May and June it produces many small yellowish-green flowers in clusters between the leaves; and the flowers are succeeded by berries which ripen in September. These berries, the officinal part of the plant, are black, shining, globular, and about the size of peas; they contain four seeds; and they abound in a green juice of an unpleasant odour, and a nauseous, bitter, rather acrid taste. They may be distinguished from the berries of *Rhamnus frangula*, and other berries which are sometimes substituted for them, by having four seeds, and by imparting a green colour to paper when squeezed on it. The juice, which becomes gradually red owing to the developement of acetic acid in it, may be preserved long unchanged

in the form of syrup, which is its sole officinal form. When evaporated to dryness with lime, it forms the colour called sap-green. It is composed of green colouring matter, sugar, brown mucilage, and bitter extractive (Hubert), the last of which substances is thought, though upon insufficient grounds, to be its active part.

Actions.—Buckthorn berries are powerfully cathartic. Twenty fresh berries cause brisk watery purging. They have the disadvantage of exciting nausea, dryness of the throat, thirst, and tormina; which effects are only in part removed by giving the juice in the form of syrup. In this form buckthorn-juice was long a favourite hydragogue in gout and dropsy. It is now in a great measure abandoned in regular practice, probably without sufficient reason.

The dose of its only officinal preparation, *Syrupus rhamni*, is fl.dr. iv. ad fl.unc. i.

RHATANIA, *D.* See *Krameria.*

RHEUM. *Root of an undetermined species of Rheum, L. W. Spr.* (Edin.). *Root of Rheum palmatum, W.* (Lond.). *Root of Rheum palmatum and Rheum undulatum, W. Spr.* (Dubl.).

Extractum Rhei.

Process, *Edin.* Take of
Rhubarb, one pound;
Water, five pints.
Cut the Rhubarb into small fragments; macerate it for twenty-four hours in three pints of the water; filter the liquor through a cloth, and express it with the hands or otherwise moderately; macerate the residuum with the rest of the water for twelve hours at least, filter the liquor with the same cloth as before, and express the residuum strongly. The liquors, again filtered if necessary, are then to be evaporated together to a proper consistence in the vapour-bath.—The extract, however, is obtained of finer quality by evaporation in a vacuum with a gentle heat

Process, *Lond. Dub.* Take of
Rhubarb bruised, fifteen (twelve, D.) ounces.
Proof-spirit, one (old-wine, D.) pint.
Water, (distilled, L.) seven (old-wine, D.) pints.
Digest for four days (fourteen days, with a gentle heat, L.); filter; let the impurities settle; pour off the clear liquor, and evaporate it to the due consistence.

Infusum Rhei.

Process, *Edin.* Take of
Rhubarb in coarse powder, an ounce;
Spirit of Cinnamon, two fluidounces;
Boiling-water, eighteen fluidounces.
Infuse the rhubarb twelve hours in the water in a covered vessel, add the spirit, and strain through linen or calico.

Process, *Lond. Dub.* Take of
Rhubarb, sliced, three drachms (one drachm, D.)
Boiling distilled-water, one pint (boiling-water, half a pint old wine-measure, D.)
Macerate for two hours in a covered vessel and strain.

Pilulae Rhei, E.

Process, *Edin.* Take of
Rhubarb, in fine powder, nine parts;
Acetate of potash, one part;
Conserve of red roses, five parts;
Beat them into a proper mass, and divide it into five-grain pills.

Pilulae Rhei Compositae, E.

Process, *Edin.* Take of
Rhubarb, in fine powder, twelve parts;
Aloes, in fine powder, nine parts;
Myrrh and

Castile-soap, of each six parts.
Oil of Peppermint, one part;
Conserve of red-roses, five parts.
Mix them and beat them into a proper mass, and divide this into five-grain pills. —This pill may be also made without oil of peppermint, when so preferred.

PILULAE RHEI ET FERRI, E.

PROCESS, *Edin.* Take of
Dried sulphate of iron, four parts:
Extract of rhubarb, ten parts;
Conserve of red-roses, five parts.
Beat them into a proper mass, and divide it into five-grain pills.

PULVIS RHEI COMPOSITUS, E.

PROCESS, *Edin.* Take of
Magnesia, a pound;
Ginger, in fine powder, two ounces;
Rhubarb, in fine powder, four ounces.
Mix them thoroughly, and preserve the powder in well-closed bottles.

TINCTURA RHEI, E.

PROCESS, *Edin.* Take of
Rhubarb, in moderately fine powder, three ounces and a half;
Cardamom-seeds, bruised, half an ounce;
Proof-spirit, two pints.
Mix the rhubarb and cardamom-seeds, and proceed by the process of percolation as directed for tincture of cinchona. —This tincture may also be prepared by digestion.

TINCTURA RHEI COMPOSITA, L. D.

PROCESS, *Dub. Lond.* Take of
Rhubarb, sliced, (two ounces and a half, L.);
Saffron, two (three, L.) drachms;
Liquorice root, bruised, four (six, L.) drachms;
Cardamom-seeds, bruised, half an ounce (*instead of which*, Ginger, six drachms, L.);
Proof-spirit, two old-wine (imperial, L.) pints.
Macerate for seven (fourteen, L.) days, and strain.

TINCTURA RHEI ET ALOES, E.

PROCESS, *Edin.* Take of
Rhubarb, in moderately-fine powder, an ounce and a half;
Socotorine, or East-Indian aloes, in moderately-fine powder, six drachms;
Cardamom-seeds, bruised, five drachms;
Proof-spirit, two pints.
Mix the powders, and proceed as for tincture of Cinchona.

TINCTURA RHEI ET GENTIANAE, E.

PROCESS, *Edin.* Take of
Rhubarb, in moderately-fine powder, two ounces;
Gentian, finely cut or in coarse powder, half an ounce;
Proof-spirit, two pints.
Mix the powders and proceed as directed for tincture of Cinchona.

VINUM RHEI, E.

PROCESS, *Edin.* Take of
Rhubarb, in coarse powder, five ounces;
Canella, in coarse powder, two drachms;
Proof-spirit, five fluidounces;
Sherry, one pint and fifteen fluidounces.
Digest for seven days, strain, express strongly the residuum, and filter the liquors.

FOR. NAMES.—*Fren.* Rhubarbe.—*Ital.* Rabarbaro.—*Span.* Ruibarbo.—*Port.* Ruibarbo.—*Ger.* and *Dan.* Rhabarber.—*Dut.* and *Swed.* Rabarber.—*Russ.* Reven. *Arab.* Rawend.—*Pers.* Reywand.—*Tam.* Variatoo Kalung.—*Beng.* Rewund chini.

FIGURES of Rheum palmatum in Hayne, xii. 10.—Nees von E. 118–19—20.—Steph. and Ch. 25.—Rheum undulatum, in Hayne, xii. 8.—Nees von E. 116–17.—Steph. and Ch. 177.—Linn. Amœn. iii. 4.—Rheum compactum, in Hayne, xii. 9.—Nees von E. 121.—Rheum Emodi, in Bot. Mag. 3508,—as Rheum australe, in Hayne, xii. 6.—Nees von E. 31. Suppl.—Rheum Webbianum, in Royle, Him. Bot. 78.[a] 1.—Rheum spiciforme, in Royle, Him. Bot. 78.—Rheum hybridum, in Nees von E. 30.—Rheum leucorhizon, in Ledebour, Icon. 491.—Rheum rhaponticum, in Hayne, xii. 7.—Nees von E. 113–14–15.

THERE is no subject in the Materia Medica more enveloped in obscurity than rhubarb. Even the period of its introduction into medicine is doubtful. Though some imagine it to be described

under the name of 'Ρα or 'Ρηον by Dioscorides, his description does not correspond with the modern drug. The Arabian physicians, as appears from Avicenna, were acquainted with true rhubarb, and even knew three kinds of it, whose names of Turkey, Indian, and Barbarian rhubarb bear a close analogy to the three designations of the chief sorts now used in European medicine. Hayne alleges that true rhubarb was unknown in Germany even till so lately as the close of the fifteenth century; but it was probably employed in Europe long before that date.

Natural History.—Not less unsettled are its botanical relations. Nor is this surprising. The genus *Rheum*, to which rhubarb belongs, comprises numerous species very widely diffused over the Asiatic continent; for it is met with as far west as the Caspian shores, as far east as within the Chinese wall, south on the Himalaya mountains which bound upper India, and north along the Altaï range and towards Lake Baikal. The extent of country from which rhubarb of one kind or another is actually collected, though somewhat more limited than this, nevertheless stretches from Ludak in 77½° east longitude to the Chinese province of Shen-si twenty-nine degrees farther east, and from the Sue-chan mountains in north latitude 26° upon the south-western confines of China-Proper, nearly to the frontiers of Siberia twenty-four degrees northward. This immense territory has been seldom penetrated at all by Europeans; and botanists have hitherto visited no more than its outskirts. Chiefly through their means many species of the rhubarb genus have been introduced into Europe, and examined scientifically. But there is no certainty that any of these produces the commercial rhubarbs from the East. For on the one hand, botanists have derived their materials essentially from incompetent sources; and on the other hand, the several species are so closely allied in their characters, and so prone to cross with one another, that even in favourable circumstances no small scientific skill is required to distinguish them. Farther, it would appear from recent inquiries, that the best qualities of commercial rhubarb are in all probability produced five or six hundred miles north of the British territories of Assam, in the very heart of Thibet, about 95° east longitude and 35° north latitude, near the sources of the great Hoang-ho river (Royle), and chiefly in the province of Gansun (Calau);—a district with which no express communication has yet been held by any good European authority. It seems probable therefore, that the true rhubarb plant is not yet ascertained, and may still remain to be discovered.

It may be right nevertheless to enumerate here the several species, to which rhubarb of one kind or another has been referred.—1. *Rheum rhaponticum*, Linn. a native of the northern shores of the Caspian and of the Altaï mountains, is generally conceived to have produced the 'ρηον of the Greeks. It is cultivated in England and France for making European rhubarb, and for the sake of its acid

leaf-stalks, familiarly used in tarts.—2. *Rheum palmatum,* Linn. Plant. Rariores,—supposed, but on slight authority, to grow near the western end of the Chinese wall, and thence southward through Thibet,—was first raised in Europe from seeds got as those of Russian rhubarb in 1750 by Kauw Boerhaave from a Tartar merchant, and was first accurately described in 1763 by Dr John Hope of this University.—3. *Rheum undulatum,* Linn. Hort. Upsalensis, first raised in Europe from the same sample of seeds as the last, but somewhat earlier, was supposed also to have come originally from the same locality, and is now known to grow generally throughout Thibet, Tartary, and even Siberia. This species too is used in France for making European rhubarb.—4. *Rheum compactum,* Linnæus, whose introduction into Europe is unknown, but which is supposed on the authority of Linnæus to have also come from Chinese Tartary, is another species raised in France for making rhubarb, and in Britain for its acid leaf-stalks.—5. *Rheum Emodi,* Wallich, was not long ago ascertained by that botanist to grow abundantly among the Himalaya mountains in northern India; a discovery, which various competent authorities, who either saw the plant in its native locality or examined it as raised in this country, were led for some time to suppose, had at length solved the question as to the origin of eastern rhubarb (Don, &c.)—6. *Rheum hybridum,* Murray, Comm. Gott. a dubious species, of unknown origin, and supposed to be a cross between *R. palmatum* and *R. rhaponticum* (Nees von Esenbeck), produces a root considerably resembling that of the former of these species, and is much cultivated in Germany for its root, and in Britain for its acid leaf-stalks, since no other species grows more readily. It produces the largest roots I have ever seen from any cultivated species; but it does not perfect its seeds.—The following species are also probably used for making a sort of rhubarb, in use where the plants grow. 7. *Rheum Webbianum,* Royle's Bot. Himal. has been recently established as a new species by Professor Royle from specimens obtained near Gossain-than in Nepaul, on the southern slope of the Himalayas.—8. *Rheum spiciforme,* Royle, another species ascertained by the same authority, has been found in abundance on the northern slope of the Himalayas in the Kherang pass, and the adjoining Tartarian territory.—9. *Rheum Moorcroftianum,* Royle, a third species determined by this botanist from specimens in Dr Wallich's Collection, has also a similar source.—10. *Rheum crassinervium,* Fischer, was sent lately to London under this name by Dr Fischer of St Petersburg; but its origin is not known (Lindley), and it is probably a doubtful species.—11. *Rheum leucorhizum,* Pallas, from the Kirkghese desert, and—12. *Rheum caspicum,* Fischer, from the Altaï mountains, both of which are less known, may be also added to the foregoing as capable of producing a kind of rhubarb.

Several of these plants thrive at great elevations, having been

lately seen growing in profusion on the Himalaya mountains, at heights of ten, twelve, or even sixteen thousand feet. It is believed to be ascertained, that the roots of all are purgative, and approach more or less nearly to Eastern rhubarb in their external characters and properties. Those to which the true drug has been most confidently referred are *Rheum palmatum*, *undulatum*, *compactum*, and *Emodi.* The best authorities in pharmacology, however, now agree that the roots of the last three have neither the taste nor odour of true rhubarb. Guibourt says he is satisfied from a careful examination of roots cultivated in France, that *Rh. palmatum,* the species to which the drug of commerce was first referred, is the only one possessed of the genuine taste and odour; Dr Pereira confirms this opinion from his own observation; and experiments I have made with these and various other species, raised in the Botanic Garden of this city, lead to the same conclusion. Since the root of *Rh. palmatum* also presents nearly the same internal structure as eastern rhubarb, and agrees with it in other qualities, this plant would appear to have still the best claim to be considered the real source of the drug.

Every species of *Rheum* noticed above has a perennial root, which produces annual root-leaves and a herbaceous flowering stem. The leaves, which are very large, commonly more or less cordate, and in general wavy or deeply cut on the edge, have an acid taste, owing to the presence of malic and oxalic acids (Everitt); and the leaf-stalks possess in spring a strong, agreeable acidity, on account of which they are in great request in this country for making tarts and other articles of confectionary. The root, the only officinal part, is in every species very thick, succulent, fibrous, and commonly bright yellow, veined with orange. It is supposed that in the rhubarb country the drug is prepared from the roots of plants at least six years old, by digging them up in the spring,—cutting them into pieces, which are perforated and strung upon cords,—and then drying these variously in different places, sometimes quickly with artificial heat and in the sunshine (Du Halde), sometimes slowly in the shade (Sievers), sometimes carelessly by attaching them to the horns of sheep or hanging them round tents (Bell). When thus prepared, rhubarb is transported either to the Russian frontiers and thence to St Petersburg, or through China to Canton; and it is chiefly from these two cities that eastern rhubarb is distributed to the rest of the world.

Three principal varieties are met with in British trade, Russian, Chinese, and English rhubarb.

1. Russian, also variously called Turkey, Moscow, Bucharian, or Siberian, Rhubarb, is first conveyed, under an arrangement between the governments of Pekin and St Petersburg, to Maimatchin on the Chinese frontier. It is then sorted at the neighbouring Siberian town of Kiakhta under the inspection of a Russian apothecary: the finer qualities alone are purchased, and subsequently trans-

ported to St Petersburgh, where it is again sorted, and shipped for other countries. It is in irregularly roundish cylindrical, or flat plano-convex pieces, commonly from an inch to three inches in breadth, always obscurely angular, owing to the root-bark having apparently been sliced off with a knife, and often perforated with a hole, by which they had been strung up to dry. Their outer surface is yellow and thinly covered with a yellow powder, probably owing to friction upon one another; and they give a bright yellow streak when scratched with the knife. Their texture is rather compact, their fracture uneven, and its surface beautifully marbled with irregularly waving grayish and reddish veins. They may be reduced without difficulty to powder, which has a bright yellow colour. Russian rhubarb has a peculiar, aromatic, bitter, faintly astringent taste. It has a strong, peculiar odour, which is probably adventitious and acquired through changes during desiccation, because it is not possessed by any of the cultivated roots in the fresh state, although several species acquire it when dry (Geiger). I have verified this with respect to *Rh. palmatum.* This kind of rhubarb tinges the saliva yellow, and produces a remarkable sense of grittiness between the teeth, owing to crystals of oxalate of lime being largely contained in it. It is entirely free of spots, cavities, mouldiness, and impurities of every kind. The finest qualities of it, including especially the small cylindrical and large flat pieces, are distinguished in continental commerce by the name of Persian or Turkey rhubarb, and were at one time brought to Europe through Persia and Syria (Guibourt).

2. Chinese, or East-Indian, Rhubarb, is conveyed, probably from Thibet and the adjoining western provinces of China, to Canton, and exported thence to Europe directly, or through Singapore. The finest quality of it, distinguished in the drug-trade by the name of Batavian, or more generally Dutch-trimmed rhubarb (Pereira), differs in no apparent respect from the Russian kind, except that the holes sometimes contain a fragment of the cord by which the pieces had been strung together, and have not been cleaned out with the knife. What is ordinarily called Chinese rhubarb in English trade consists of irregular pieces, which are never angular, like Russian or Dutch-trimmed rhubarb, but smoothly rounded at the edges, as if the bark had been removed by scraping or rasping. Their outer surface is of a rather duller yellow colour than Russian rhubarb, their density somewhat greater. and their texture more compact; but the appearance of a fresh fracture is the same. They are often perforated, and the holes frequently contain fragments of cord. They are not of such uniform quality as Russian rhubarb,—being some of them but partially stripped of their bark, more or less invaded by insects, or stained by damp and other causes. The fine pieces however are probably not different in any essential respect from that which comes by way of St Petersburgh; and they have almost precisely the same colour, odour, taste, and

grittiness. Average Chinese rhubarb yields a yellow powder slightly inclining to tawny; but picked pieces, thoroughly cleaned before being pulverized, produce a powder of a clearer hue, undistinguishable from that of powder of Russian rhubarb.

3. ENGLISH RHUBARB is prepared in various parts of this country, but chiefly near Banbury in Oxfordshire, where twenty tons are produced annually from the roots of *Rheum rhaponticum* alone (Bigg). It is got in October and November from plants three or four years old. It is easily distinguished from the Asiatic kinds by presenting externally a reddish hue and brownish spots of adhering bark, and internally a looser, softer, spongy texture, with occasional cavities, especially in the centre. It is more easily scratched with the nail, and yields a lighter yellow-streak. The surface of a fresh fracture however shows the same marbled red and gray lines; but they are in general more straightly radiated from the centre. In taste and odour it resembles the eastern rhubarbs; yet it is more mucilaginous, does not, like them, feel gritty between the teeth, and has a much more feeble odour.—The inferior qualities, sometimes termed Stick rhubarb, are in longish or irregular pieces, and in every way have a coarse appearance. The better sort from Banbury is in short, trimmed, cylindrical pieces, usually called Dressed rhubarb (Pereira); and these are sometimes rubbed over with turmeric powder, to make them pass with the ignorant for the Russian kind. All of them yield a dingy yellow powder. The very best is low in quality, and is chiefly used for adulterating the powder of true eastern rhubarb.

Other varieties have been described by recent pharmacologists; but as they are unknown in British commerce, it is scarcely necessary to do more than mention them here. *White rhubarb* is a variety of the Russian kind specified by Pallas as of superior quality, and characterized by its white colour, and sweetish taste; but it is now unknown in trade, or at least not distinguished. *Himalayan* or *Emodi rhubarb*, which has been introduced into this country in specimens only, is brown, fibrous, and without odour; and, if I may judge from specimens in my possession, it is a coarse and inferior article. Nevertheless, it is said by Mr Twining to be an excellent laxative, scarcely yielding to Chinese rhubarb in activity. *French rhubarb* is made largely at an establishment called Rheumpole, near the Port of Lorient, from the roots of *Rheum rhaponticum, undulatum,* and *compactum* (Guibourt). It has neither the odour nor aromatic taste of eastern rhubarb.

Chemical History.—The chemical properties and composition of rhubarb have been made the subject of numerous analytic investigations; which have not hitherto yielded satisfactory results. Water, cold or boiling, dissolves its active ingredients. Boiling water forms with all the three species a fine orange-coloured solution, the effects of reagents upon which seem to depend on its containing tannin and a peculiar principle called Rhabarberin. Nitric

acid causes with an infusion of Russian rhubarb in twenty parts of water a dense muddiness, and slowly a yellow precipitate, owing to the separation of rhabarberin; tincture of iodine occasions a tawny muddiness, probably for the same reason; solution of potash strikes a fine blood-red colour by combining with the rhabarberin, as with an acid; and lime-water produces at first a pale cherry-red haze, which slowly gives place to a red precipitate composed of rhabarberin and lime. Sesquichloride of iron produces a green precipitate, and solution of isinglass a yellow curdy deposit, owing to the presence of tannin. Chinese rhubarb is generally affected by these reagents in the very same way, and even to the same degree. British rhubarb, as I have generally found, yields the very same results as Russian rhubarb, except that nitric acid, potash, and lime-water do not act with the same intensity. Though all the three varieties appear to contain starch, it is for the most part not indicated in an infusion by tincture of iodine, although such is stated to be the case in most pharmacological works. The usual effect of tincture of iodine is to occasion a tawny muddiness in the infusions. In all rhubarbs however starch is clearly detected by the same test causing a blue precipitate with an infusion, which is prepared from the residuum left after powdered rhubarb has been exhausted by cold water, and then by rectified spirit (Geiger).——When rhubarb is boiled in water till it becomes soft, and is then crushed and agitated in the water, pale gray sandy grains separate and subside, which are seen under the microscope to be solid groups of radiated crystals of oxalate of lime. These are generally much more abundant in the Eastern rhubarbs than in what is grown in Europe; and Mr Queckett has obtained between 35 and 40 per cent from the Russian variety. Dr Pereira says he has occasionally found them abundantly in English rhubarb. They are the cause of the grittiness remarked in chewing the finer species.

Water is employed for making the officinal *Infusum* and *Extractum Rhei.* The former preparation, made with boiling water alone, is an ineligible one, as it becomes turbid on cooling, owing to a partial separation of rhabarberin and other principles. Cold water used in the way of percolation is a better menstruum; or precipitation may be prevented in the hot infusion by adding a little spirit, as in the Edinburgh formula. In like manner cold water should be used for preparing the extract; and if it be employed in the way of percolation, the spirit directed by the London and Dublin Colleges to be added in aid of its solvent action becomes unnecessary. This extract should be prepared, if possible, in vacuo. I may add my testimony to Dr Pereira's, that, when so made, the lapse of twenty years does not impair its taste or odour.

Proof-spirit is a more ready solvent of the active ingredients of rhubarb than water. It is employed for preparing the officinal *Tinctura Rhei;* for which purpose it is best applied in the way of

percolation. It is likewise used by the Edinburgh College for a variety of compound tinctures.

The composition of rhubarb has been studied by various chemists and with different results Brandes, in 1836, represented the Russian variety to consist of 2 per cent of a peculiar principle Rhabarberin in the pure state, 10 per cent more in an impure form, 9 per cent of tannin, 4 starch, 11 sugar in union with tannin, 14.4 gummy extractive, 3.5 colouring extractive, 4.0 pectic acid, 11.0 oxalate of lime, 1 malate and gallate of lime, 1.5 inorganic salts, iron, and silica, and 25 lignin. The principles indicated by prior experimentalists under the names of Rhein, Rheumin, Rhabarberin, Caphopicrite, seem to be the rhabarberin of Brandes combined with other principles. Rhabarberin, considered by its discoverer the active principle of rhubarb, was obtained by him on agitating the powder with ether, distilling off most of the ether, and letting the residuum evaporate slowly till crystals form. The following is the most recent process for it. An alcoholic extract of rhubarb is purified by acting on it with cold water. The residue is dried, dissolved in the smallest possible bulk of spirit, and ether added so long as it separates anything. The ether is distilled off, and the residue is again similarly treated with spirit and ether. The solution yields it pure by spontaneous evaporation (Schlossberger). The principle thus obtained is granular, yellow, tasteless and colourless, fusible, partially volatile, sparingly soluble in water, more so in alcohol or ether, and acid in its reactions. Alkaline solutions dissolve it, forming intensely red solutions, from which acids separate it as a yellow precipitate, and which, with the earthy salts, give yellow precipitates of the principle united with an earthy base. Ultimate analysis shows that it is identical with a colouring matter (chrysophanic acid) obtained by Rochleder from the yellow lichen *Parmelia parietina* (Schlossberger). It does not appear to be the active principle of the root. By some chemists the aroma of rhubarb has been ascribed to a trace of volatile oil; several resins have been found in it (Schlossberger and Doepping); starch and oxalate of lime have already been mentioned as constituents. The latter is generally much more abundant in the eastern rhubarbs than Brandes' results would indicate.—Hornemann found in what he calls English rhubarb, but which was probably the Chinese variety, almost the same ingredients as in the Russian sort. In the root of *Rheum rhaponticum* he likewise found similar ingredients, but much more starch, namely, 14.5 per cent, and a crystalline principle supposed to differ from the rhabarberin of Brandes, and which he calls Rhaponticin. The root of *Rheum Emodi*, one of the sources of Himalayan rhubarb, has been examined by Ossian Henry; who found it to be composed on the whole like Russian rhubarb, but to contain little oxalate of lime, not much rhabarberin, and a large proportion of pectic acid.

Adulterations.—Rhubarb is very liable to adulteration. The

fine qualities of eastern rhubarb are easily known when in pieces by their strong aroma, their powerful bitterness and grittiness between the teeth, their freedom from brown specks externally or internally, their compact marbled organization, and the want of perforations by insects. They are often adulterated with the inferior sorts of home growth. These are easily detected while the drug is in mass by their weaker aroma, and want of grittiness when chewed; and if their surface has been rubbed over with turmeric to heighten their yellow colour, this will be discovered by boracic acid turning the yellow to brown, because the true yellow colour of rhubarb is not thus altered. But if the adulterated rhubarb be in the state of powder, the fraud is very difficult to detect; and indeed detection is scarcely possible, if the spurious ingredient be added in moderation.

Actions and Uses.—Rhubarb is a cathartic, astringent, and tonic. As a cathartic, it operates fully more by increasing the muscular action of the intestines, than by augmenting their secretions. It is usually considered to act upon the whole course of the intestinal canal, and especially upon the duodenum. It is also thought by some to excite the secretion of the bile; but this doctrine is probably based on nothing else than the colour it imparts to the evacuations, which may be equally well referred to its own intense yellow hue. When the cathartic action of rhubarb is over, it is succeeded in general by an opposite state of the intestines, which is usually ascribed to its astringent properties coming into play. Its astringency is too feeble to counteract altogether the cathartic action, but operates subsequently with such force, as to have acquired for rhubarb the reputation of being secondarily a calmative, as well as directly a stimulant, of the intestinal canal. These effects are farther accompanied for the most part with a tonic action on the stomach, indicated by improved appetite and digestion. It is absorbed in the course of its operation; for the serum of the blood becomes yellow, the urine red, and the sweat tawny. The red urine caused by rhubarb has sometimes been mistaken for bloody urine, but may be distinguished by the effect of heat, which coagulates blood, and removes the red colour, but does not affect the tint communicated by rhubarb.

The special applications of this drug are numerous. It is one of the best laxatives for general use in infancy; for it is not apt to act with unexpected violence, and its tonic and astringent virtues render it peculiarly fit for the treatment of the many infantile diseases attended with enfeebled digestion and irritation in the alimentary canal. In consequence of its tendency to induce constipation consecutively, it is not so eligible a purgative for common use in adults. From its mildness it is an appropriate laxative in cases of chronic diarrhœa and dysentery; in convalescence from exhausting diseases; and in some irritable habits, in which all other laxatives, even the mildest of them, are apt to excite hypercathar-

sis. It is with many a favourite tonic and stomachic, especially in combination with carbonate of soda.

The best officinal preparations of rhubarb for general use are the simple powder,—the compound powder of the Edinburgh Pharmacopœia, long familiarly known by its trite name of Gregory's powder,—and the simple and compound pills. The infusion is an inferior preparation as a purgative; the simple tincture is more used as a tonic than as a laxative, except in those constitutions which are peculiarly sensible to the operation of laxatives; but the combination of aloes in the officinal *Tinctura rhei et aloes*, by strengthening its action, renders this tincture a more convenient purgative. The compound powder contains magnesia and ginger in addition to the rhubarb,—the former to impart antacid properties, the latter to correct the tendency to griping. The compound pill, which contains nearly as much aloes as rhubarb, is one of the best laxative pills for common use yet known. Rhubarb is also conveniently united with calomel, especially in the diseases of children. Two or three grains of calomel with twice as much rhubarb-powder constitute an excellent cathartic mixture in the disorders of the stomach and bowels which frequently occur in children between the ages of two and five years. The sulphate of iron in the *Pilula rhei et ferri* is thought to increase the laxative effect of rhubarb.

The preparations of rhubarb and their doses are as follows: *Pulvis rhei*, tonic, gr. iii. to gr. x.; laxative, gr. x. ad dr. ss.—*Pulvis rhei compositus*, dr. i.—*Tinctura rhei*, fl.dr. i. ad fl.dr. ii.—*Tinctura rhei et aloes*, fl.unc. ss. ad fl.unc. i.—*Tinctura rhei et gentianæ*, fl.dr. i. ad fl.dr. ii.—*Tinctura rhei composita*, fl.dr. i. ad fl.dr. ii.—*Infusum rhei*, fl.unc. ii. ad fl.unc. iv.—*Vinum rhei*, fl.dr. i. ad fl.dr. ii.—*Pilulæ rhei*, gr. x. ad gr. xv.—*Pilulæ rhei compositae*, gr. x. ad gr. xv.—*Pilulæ rhei et ferri*, gr. x. ad gr. xv.

RHOEAS, *L.* RHOEADOS PETALA, *E.* PAPAVER, RHOEAS, *D.* *Petals of Papaver Rhœas, L. W. DC. Spr. Corn-poppy.*

SYRUPUS RHOEADOS, E. L. SYRUPUS PAPAVERIS RHOEADOS, D.

PROCESS, *Edin. Lond. Dub.* Take of
Corn-poppy, a pound;
Boiling-water, a pint;
Pure-sugar, two pounds and a half;
Heat the water over a vapour-bath, add the petals by degrees, stirring occasionally; remove the vessel from the bath, infuse for twelve hours (at a gentle heat, D.); strain and express the liquor; add to it the sugar, and dissolve this with the aid of heat. (Make a syrup in the usual way, D.)

FOR. NAMES.—*Fren.* Coquelicot.—*Ital.* Papavero silvatico; Papavero erratico.—*Span.* Amapola.—*Port.* Papoila.—*Ger.* Klatschrose; Klatschrosen-mohn; Wilde Mohn.—*Dut.* Kollebloem.—*Swed.* Vild valmode.—*Dan.* Vild valmue.

FIGURES of Papaver Rhœas in Nees von E. 406.—Hayne, vi. 38.—St. and Ch. i. 31.—Engl. Bot. 645.

THE CORN POPPY is the Μηκων ῥοιας of Dioscorides, and has constantly been an article of the Materia Medica since his time.

It is the *Papaver Rhœas* of existing botanists, an annual herbaceous plant belonging to Linnæus' class and order *Polyandria Monogynia*, and to the Natural family *Papaveraceæ*. It abounds in corn-fields and along hedge-rows, in this and other European countries. It has a slender stem, beset with bristly hairs, and about two or three feet in height. It bears in June and July several large, tender, deep-scarlet flowers, which are succeeded by small obovate capsules. The petals, the only officinal part of the plant, drop off very easily. They should be collected in dry weather, and dried quickly with the aid of a gentle heat and a current of air; otherwise they lose their fine colour. When dry, they have a more dingy hue and are scentless; but they emit when fresh a heavy odour like that of opium. They communicate their colour readily to water, and the colour is preserved by converting the infusion into syrup; which is their only officinal form. They contain a yellow fatty substance, 40 per cent of a red colouring matter, a good deal of gum, and probably a little tannin (Riffard). The green capsules, when wounded, discharge a milky juice, which concretes into a substance similar to opium in appearance, and probably also in composition as well as physiological properties.

The syrup of corn-poppy is employed only for imparting colour to mixtures, and seldom now even for that purpose. The Greeks considered its capsules hypnotic, its seeds laxative, and its leaves locally anodyne and emollient.

RHUS TOXICODENDRON, *D.* See *Toxicodendron.*

RICINI OLEUM. *Expressed oil of the seeds of Ricinus communis, L. W. Spr. Castor-oil.*

TESTS, *Edin.* It is entirely dissolved by its own volume of alcohol.

FOR. NAMES.—*Fren.* Huile di ricin.—*Ital.* Olio di ricino.—*Span.* Aceyte de ricino.—*Port.* Azeite de mamona.—*Ger.* Ricinus-öl.—*Dan.* Purgeerkornolie.—*Russ.* Kleshevinnoe maslo: Kastorovoe maslo.—*Arab.* Duhn ul kherooa.—*Pers.* Rowgen Bedangeer.—*Tam.* Sittamoonakayunnay: Cottay unnay.—*Beng.* Oobali erundyka tel.

FIGURES of Ricinus communis in Nees von E. 140.—Hayne, x. 48.—St. and Ch. i. 50.—Roque, 168.

CASTOR-OIL has been used in medicine since at least the time of the Greek physicians, by whom the plant which produced it was called κικι or κροτων, and the oil κικιον ἐλαιον. The plant was the Ricinus of the Latins, whence its present botanical name.

Natural History.—The Castor-oil tree belongs to the Linnæan class and order *Monœcia Monadelphia*, and to the Natural family *Euphorbiaceæ*. It occurs, probably native, in Greece, Africa, and the East Indies, and is also cultivated throughout the south of Europe, in the West-Indian islands, and on the continent of North and South America. Some have supposed that the oil of commerce is derived from several species of the same genus. But the

latest authorities agree that these are mere varieties of a single species, the *Ricinus communis*, which is modified in a remarkable degree by cultivation or by climate. In the northern and middle counties of Europe it is a herbaceous annual from three to eight feet high; in Spain and Sicily it becomes a small tree, towards twenty feet in height (Clusius, Ray); and in India it sometimes attains the elevation of forty feet, and lives many years (Roxburgh). It has beautiful, deeply-cut, palmated leaves, and produces, in Europe during July and August, long spikes of green, glaucous, monœcious flowers; which are succeeded by tricoccous, smooth, or more generally spiny, capsules. Each capsule contains three seeds, which are longish-ovate, somewhat flattened on one side, in size varying from that of a lupin to that of a haricot, differing also in weight from two to eight grains, and beautifully marbled externally with gray, reddish-brown or blackish-brown spots. The seed consists of a thin ligneous, brittle husk, a delicate, white, silky, investing membrane, and a thick, fleshy, oleaginous nucleus, enclosing a large, dicotyledonous leafy embryo. In its general appearance it somewhat resembles the tick which infests some of the domestic animals; whence probably was derived its Roman name Ricinus. The husk, which constitutes 24 per cent of the seed, is composed chiefly of ligneous fibre, with a little gum, resin, and extractive matter. The nucleus, which amounts to 69 per cent of the seed when dry, contains 46.2 of fixed oil, 2.4 of gum, 0.5 soluble albumen, and 20 of coagulated albumen (Geiger); but it must also contain a peculiar acrid and purgative principle, not as yet discovered, for it is powerfully active after expression of the oil (Mialhe). The fixed oil is the Castor-oil of the shops.

English commerce is supplied with castor-oil chiefly from the East-Indies, but in part also from the West-Indies and North-America; and sometimes it has been prepared in London from seeds imported for the purpose. In 1831 the imports of the oil amounted to about 400,000 pounds, of which nearly seven-eighths came from India (Pereira). It was at one time prepared in London from the large variety of castor-oil seeds, by depriving them of the husk, bruising them into a pulp, and subjecting the pulp to strong pressure without heat. In the East-Indies the small seeds, which are most esteemed for medical use, are sometimes subjected to a similar process; but more generally they are first steeped for a night in cold water, then boiled for two hours in a fresh portion of water, next dried in the sun and bruised, and lastly boiled in more water, with constant stirring, till the oil all separates and rises to the surface (Ainslie). The large variety of seed similarly treated, but after a preliminary roasting, yields an inferior oil, said to be chiefly used for burning, under the name of Lamp-oil. In the West-Indies the same process nearly is followed as for the better sort of oil from the East, except that the seeds are not steeped or boiled before being bruised (Duncan). In North-America the seeds are gently heated,

bruised, and expressed; the oil is then boiled with water, to dissolve out mucilage and coagulate albumen; and it is finally boiled with a small quantity of fresh water till aqueous vapours cease to be disengaged (Wood and Bache). Much has been written on various processes as affecting the quality of the oil, more especially in respect to acridity. The acridity, often complained of, has been variously ascribed to the large-seeded variety being used instead of the small,—or to the embryo, or husk, or white perispermal tunic, not being removed before the process of expression or decoction,—or to the oil being separated, not by simple expression in the cold, but with the aid of heat, especially in the dry way. The latest and apparently most accurate experiments seem to show, that by simple expression a mild oil of excellent quality may be extracted alike from the large and small varieties of the seed: That, when so prepared, it is apt to become rancid (Wright), but may be prevented from doing so if heated to about 200°, so as to separate albumen: That the husk and perispermal membrane are inert, and the embryo scarcely more active than the albumen of the nucleus, (Boutron and Henry): That if the seeds be boiled in the Eastern way, without first roasting them, or afterwards driving off the residual water from the oil by heat, an oil of fine quality is obtained, which keeps well (Guibourt), but is probably not quite so active: That the active part of the oil is probably volatilizable during decoction with water (Guibourt), so that long ebullition may materially impair its energy: And that, if the seeds be roasted before being expressed, or the oil be exposed to a considerable heat as in the American process, peculiar acids are engendered, which greatly increase the acridity (Bussy and Lecanu).

Chemical History.—The Castor-oil in most esteem is that obtained by expression without heat, and therefore commonly called COLD-DRAWN CASTOR-OIL. It has a very pale straw-yellow colour, considerable unctuous viscidity, a faint sweetish taste, and scarcely any odour. It has a density of 964 at 60°, and is one of the heaviest of the fixed oils. When exposed to a cold a little below 32°, it slowly becomes thick and turbid, and at length deposits a very few crystalline grains of margarin; but no margarin separates, if the oil has been previously heated to 212°, either with or without water (Boutron-Charlard). It may be distilled at a temperature about 510°, but not without undergoing important alterations; for three acids are formed, the ricinic, elaïdic, and margaritic acids (Bussy and Lecanu), which are acrid, and impart to it irritant properties. When exposed to the air, it becomes rancid, thickens, and at length dries up. Water has no action on it. Ether dissolves it in all proportions. So does alcohol; and even rectified-spirit takes up about a third of its volume,—a property not possessed by any other common fixed oil except the concrete palm-oil. Other oils, fixed as well as volatile, readily combine with it. The alkalis in solution dissolve and saponify it, producing peculiar acids,

apparently identical with those already mentioned as being generated during distillation. Of the acids the most remarkable in its action on castor-oil is the hyponitrous acid. This acid will convert twenty times its weight of oil in seven hours into a firm yellow solid substance, called Palmin, which is saponifiable by alkalis, and then yields a peculiar acid, termed Palmic acid (Boudet).—The proximate constitution of castor-oil is obscure. In the first place, it does not consist, like other fixed oils, of a solid margarin and a fluid elaïn; for in general these principles cannot be detached from it by cold or alcohol, and the process of saponification does not produce the fatty acids always engendered where they exist. Consequently chemists rather incline to the opinion, that it consists substantially of a single and peculiar oleaginous principle. But farther, the source of its laxative qualities has not yet been discovered. Soubeiran indeed obtained an acrid resin after saponification of the oil by potash. This substance however is probably formed during the process by which it is separated; and from what Guibourt and others have observed of the effects of ebullition with water, as well as from what is known of the source of activity in the allied oil obtained from croton-seeds, it seems most probable that the active constituent is a volatile, irritant acid. The elementary constitution of the oil is according to Saussure 74.18 per cent of carbon, 11.03 hydrogen, and 14.79 oxygen; but Dr Ure has obtained results somewhat different.

East Indian Castor-oil, when carefully prepared, differs little from the cold-drawn castor-oil prepared in Europe, and it is largely imported, sold, and used as cold-drawn oil. The principal difference is, that it does not deposit any grains of margarin when exposed to a cold below 32°. After reaching this country, it is sometimes muddy, but it may be cleared by filtration through flannel. It is generally thought less active than cold-drawn oil, but this notion is doubtful. Others on the contrary think it more acrid; but it is not intrinsically so, and this objection applies only to its inferior qualities. The best of it is clear, very pale, sometimes indeed almost colourless. The inferior kinds are brown, often acrid to the taste, of a disagreeable odour, and apt to be severe in action, probably in consequence of the presence of pyrogenous acids. The American Castor-oil, imported from the United States, is said by Dr Pereira to be of very fine quality, but to be objectionable in the eyes of the druggist, because in cold weather it deposits crystalline grains. If the statement made above, on the authority of Boutron-Charlard, be correct, this circumstance, instead of being an objection, is strong proof of the American oil being really cold-drawn, and not prepared by dry heat and ebullition, as Drs Wood and Bache have represented. West Indian Castor-oil is imported in very small quantity into this country. What I have under that name is brownish-yellow, with a few crystalline grains and

films at the bottom of the bottle, so that it must be an inferior sort prepared without the aid of heat.

Adulterations.—Castor-oil not many years ago, before the importation of it from the East Indies rendered it abundant, was often adulterated with the common fixed oils. But in recent times its comparative cheapness has rendered this practice much less frequent, at least in Britain. The adulteration is easily detected by pure alcohol, as directed by the Edinburgh Pharmacopœia; for the impurity is detached by this reagent, which dissolves the castor-oil only. The inferior sorts of castor-oil, often substituted for the finer qualities, may be known for the most part by their rancid odour, their acrid or otherwise unpleasant taste, or their browner colour. An excessively pale oil however may also be an inferior kind, being sometimes made by decolorizing the coarser sorts with animal charcoal or otherwise. A difference of odour or taste will still enable a practised observer to detect its true quality. It deserves mention, nevertheless, that, according to Buchner, rancid acrid oil may be deprived of its disagreeable odour and taste, as well as of its acrimony, by boiling it for fifteen minutes with water and a little calcined magnesia.

Actions and Uses.—The seed whence castor-oil is obtained is in its action a powerful drastic cathartic, and irritant; and is said even to have proved fatal to man when taken to the extent of twenty seeds at once. It is clear, therefore, if this statement be true, that most of its active constituent is left behind when the oil is obtained by expression, and is destroyed or evaporated if ebullition be used; for good castor-oil exerts no other action but that of a mild, yet effectual laxative. It produces thin, feculent, not watery stools, and seldom causes more griping or sickness than may be excited by an equal quantity of other fixed oils. It is therefore most extensively employed in all circumstances where it is desirable to move the bowels gently, without occasioning local irritation or general disturbance,—such as in young children, in pregnant or puerperal females, after hernia, in hæmorrhoidal affections and other diseases of the rectum, in obstinate constipation, inflammatory disorders of the abdominal organs, and intestinal worms. The chief objections to it are its nauseous taste, and the tendency of its large dose to cause sickness. In neither respect, however, is it worse than any bland fixed oil; and both inconveniences are much exaggerated by the prepossessions of patients. It is taken sometimes alone, sometimes swimming on the surface of water or coffee, which is briskly stirred and swallowed while in motion. Others prefer it in the form of emulsion with some aromatic water. An ounce of peppermint or cinnamon water, or as much common water with a drachm of spirit of pimento, will convert an ordinary dose of oil into a good temporary emulsion, with the aid of twenty minims of potash-solution and brisk agitation. The energy of this purgative is much increased by the addition of a little oil of tur-

pentine. Two drachms of the latter with six of castor-oil, given either simply or with the materials just mentioned for forming an emulsion, constitute a compound of singular efficacy and perfect safety in cases of obstinate constipation, even though they may have resisted other powerful cathartics. Castor-oil may also be rendered an active drastic purgative by the addition of one or two drops of croton-oil; but it is then more apt to cause sickness or vomiting. It is sometimes used for making clysters; for which purpose, however, olive oil answers nearly as well.

The magnitude of the dose of castor-oil has led pharmacologists to search for substitutes for it, of equal mildness but more subtilty, among other oils of Euphorbiaceous plants. This inquiry has not been prosecuted with the attention it deserves. The oil of the seeds of the *Euphorbia Lathyris*, or caper-spurge, has been lately said to possess all the properties of castor-oil in the dose of seven or ten drops. The oil of the *Jatropha Curcas*, or physic-nut, being said to possess similar properties, I tried it a few years ago, and found from many experiments, that one sample expressed from Barbados seeds acted precisely like castor-oil in the dose of ten, fifteen, or twenty drops; but that another from Jamaica seeds sometimes caused the same severe sickness and watery evacuations as croton-oil, and at other times was inert in the dose of thirty drops.

The dose of *Oleum Ricini* varies from two drachms to two ounces, six drachms being the medium.

ROCCELLA TINCTORIA, *D.* See *Lacmus.*

ROSA CENTIFOLIA, *E. L. D.* *Petals of Rosa centifolia, L. W. DC. Spr. Damask-rose.*

ROSAE OLEUM, *E.* *Volatile oil of the petals of Rosa centifolia, L. W. DC. Spr. Attar of Roses.*

AQUA ROSAE, E. L. D.

PROCESS, *Edin. Lond.* Take of
Damask-rose petals, ten pounds;
Water, two gallons;
Rectified-spirit, three (proof-spirit, seven, L.) fluidounces;
Mix them, and distil off a gallon. (The petals should be preferred fresh; but it also answers well to use those which have been preserved by beating them with twice their weight of muriate of soda, E.)

PROCESS, *Dub.* Take of
Damask-rose petals, eight pounds;
Water, enough to prevent empyreuma.
Distil off a gallon.

SYRUPUS ROSAE, L. D. SYRUPUS ROSAE CENTIFOLIAE, E.

PROCESS, *Edin.* Take of
Fresh damask-rose petals, a pound;
Boiling water, three pints;
Pure sugar, three pounds;
Infuse the petals in the water for 12 hours, strain the liquor, and dissolve the sugar in it with the aid of heat.

PROCESS, *Lond. Dub.* Take of
Dried damask-rose petals, 7 ounces;
Boiling water, three pints;
(Sugar, six pounds, L.);
Infuse the petals for two hours, strain, concentrate the liquor over the vapour-bath to two pints, and dissolve the sugar in it (make it into a syrup, D.)

FOR. NAMES.—*Fren.* Rose à cent feuilles; Rose pâle.—*Ital.* Rosa pallida.—*Span.* Rosa de Alexandria.—*Port.* Rosas pallidas.—*Ger.* Damascene-rose;

Centifolien-rose.—*Dut.* Roozeboom.—*Swed.* Aettikenrosor.—*Dan.* Rödrose. —*Russ.* Rosa stolepestnaia; Rosa alaia.—*Arab.* Wurd.—*Pers.* Gul.—*Tam.* Goolabu-poo.—*Beng.* Goolabka phool.

FIGURES of Rosa centifolia in Nees von E. 302.—Hayne, xi. 29.—Steph. and Ch. iii. 99.

VARIOUS species of the rose tribe have been employed in pharmacy from a remote period. The several species used by the Greek physicians under the name of Ῥόδα cannot now be satisfactorily recognized; but it is thought by some that the officinal *Rosa centifolia* was the Ῥόδον ἑκατοντάφυλλον of Theophrastus.

Natural History.—The species used in modern medicine for its fragrance, commonly called the Damask-rose, has produced under the influence of cultivation an infinite number of varieties, which present very different external characters, and which are consequently considered by many to be distinct species, under the names of *Rosa damascena*, *moschata*, *pallida*, *bifera*, &c. Its native country is doubtful, but is supposed to have been the Eastern Caucasus. It belongs to the Linnæan class and order *Icosandria Polygynia*, and to the natural family *Rosaceæ*. Its corolla has naturally five petals only; but in the cultivated plants these are multiplied excessively by the conversion of stamina.

All varieties of the *Rosa centifolia* are not alike fit for medicinal use, the fragrance of some being weaker or less agreeable than that of others. Sufficient attention is not paid to this circumstance in Britain; where however it should be particularly studied, if, as some pharmacologists maintain, cultivation impairs the fragrance of certain varieties more than of others. Guibourt says, that the most suitable in France for pharmaceutic purposes is a variety of the *Rosa damascena*, sometimes called *R. bifera*, which flowers twice a-year, in the spring and again in the autumn; and that it is most fragrant when raised in open fields. The only officinal part of the plant is the petals of the flowers, which ought to be gathered before they are full blown. They may be preserved in good condition for a length of time, if immediately and quickly dried with the aid of a gentle heat and a stream of air, but much longer and better, if beat up while fresh with twice their weight of salt.

Chemical History.—The petals of the rose have a delicious fragrance, and a peculiar faintly-astringent taste, both of which are readily communicated to water and spirit. The properties of the watery infusion may be long preserved by the addition of sugar, and hence the *Syrupus rosæ* is a common officinal preparation. This is best made by the Edinburgh formula, with fresh petals and without concentration by heat. The odour of the rose passes over in distillation with water, and is owing to its only important ingredient, a peculiar volatile oil. The distilled water is officinal in all the Pharmacopœias under the name of *Aqua rosæ;* and the oil, or *Oleum rosæ,* is admitted into that of the Edinburgh College.

Three varieties of Rose-water are met with in the shops of this

country. One is prepared from the cabbage-rose, cultivated in Britain for the purpose; another is imported from France; and the third is prepared by distilling with water the oil or attar of roses. All are different in fragrance. The first becomes soonest vapid, but is not otherwise inferior to the French kind. The third is generally preferred by customers for the quality, strength, and permanence of its fragrance. An excellent rose-water may also be obtained from petals preserved for some time with salt.

The Oil or Attar of Roses is made in various eastern countries and in Egypt. In Arabia the chief rose gardens are in the neighbourhood of Mecca (Landerer). In Persia it is prepared from the *Rosa moschata.* That which is imported into Britain is chiefly made at Ghazeepore in Upper India, from the *Rosa damascena.* The manufacturing season is March and April. The flowers and calyx together are distilled with water in the proportion of 10,000 roses to fourteen seers, or about twenty-two imperial pints; and ten seers of rose-water are drawn off. The water being subsequently exposed to the cold of the night, a film of oil is found next morning on its surface, and is immediately removed with a feather. When a sufficient quantity has been thus accumulated, it is put into the little bottles in which it usually reaches this country. One hundred thousand roses, the produce of about ten thousand bushes, yield only 180 grains of attar; the value of which at Ghazeepore in 1839 was from eight to ten pounds sterling. Oil of roses is at first greenish, but afterwards presents various tints of green, yellow, and red; nor is the colour any criterion of its quality. It has an intense, and most penetrating, diffusive odour. It is concrete at all ordinary temperatures in this country, and becomes liquid about 84° F. It is soluble in about 150 parts of alcohol. It consists of 23 equivalents of carbon, as much hydrogen, and 3 of oxygen ($C^{23}H^{23}O^3$). Its stearoptin, which is abundant, seems to be a pure hydrocarbon, composed of an equal number of equivalents of each element (Blanchet).

Adulterations.—Rose-oil is often adulterated; sometimes with sandal-oil, obtained by mixing sandal-wood raspings or the oil itself with the petals in the still; and sometimes with the grass-oil of the East obtained from various species of Andropogon, but especially *A. Ivarhancusa* and *A. Calamus-aromaticus.* Some specimens of Indian-grass oil in my possession approach closely to true rose-oil in fragrance, and have been thought by some to be scarcely less agreeable. The sophisticated rose oils are known by not being concrete at ordinary temperatures. This character is said to be sometimes communicated by dissolving a little spermaceti in the fabricated article. But in that case a drop of the oil will not wholly evaporate with a gentle heat from blotting-paper.

Uses.—The preparations of the hundred-leaved rose are used only for imparting perfume to mixtures and collyria. For the lat-

ter purpose rose-water is in extensive demand. The petals and syrup are thought by some to be gently laxative.

ROSA GALLICA, *E. L. D.* *Petals of Rosa gallica, L. W. DC. Spr.* *Red-rose.*

CONSERVA ROSAE, E. D. CONFECTIO ROSAE GALLICAE, L.

PROCESS, *Edin.* Beat the petals of Rosa gallica to a pulp, gradually adding twice their weight of sugar.
PROCESS, *Lond. Dub.* Take of
Red-rose petals, a pound ;
Pure sugar, three pounds.
Bruise the petals in an earthen-ware mortar, add the sugar, and beat the whole into a uniform mass.

INFUSUM ROSAE, E. INFUSUM ROSAE COMPOSITUM, L. INFUSUM ROSAE ACIDUM, D.

PROCESS, *Edin. Lond. Dub.* Take of
Red-rose petals dried (without the claws, D.) three (four, D.) drachms ;
Diluted sulphuric acid, one fluidrachm and a half (3 drachms by measure, D.) ;
Boiling water (distilled, L.), a pint (three old wine pints, D.) ;
Sugar, six (twelve, D.) drachms ;
Edin. Infuse the petals in the water in a covered vessel or glass of porcelain, not glazed with lead, for an hour ; add the acid, strain through linen or calico, and dissolve the sugar in the liquor.
Lond. Dub. Pour the water over the petals in a glass vessel ; add the acid, infuse for six hours (half an hour, D.), strain the liquor (when it is cold, D.), and add the sugar.

MEL ROSAE, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Red rose petals dried (without the claws, D.), four ounces ;
Boiling water, two pints and a half ;
Honey, five pounds.
Edin. Infuse the petals in the water for six hours, strain and squeeze ; let the impurities subside ; pour off the clear liquor, mix with it the honey, and evaporate the whole to the consistence of syrup, removing the scum.
Lond. Dub. Infuse the petals in the water for six hours, strain, add the honey, and evaporate in the vapour-bath to the due consistence. (Boil down to a syrup, removing the scum, D.)

SYRUPUS ROSAE GALLICAE, E.

PROCESS, *Edin.* Take of
Dried Red-rose petals, two ounces ;
Pure sugar, twenty ounces.
Proceed as for Syrup. Ros. centifoliae.

FOR. NAMES.—*Fren.* Rose rouge ; Rose de Provins.—*Span.* Rosa rubra ; Rosa castellana.—*Port.* Rosas vermelhas. —*Ger.* Französische rose ; Essig-rose.—*Swed.* Provins-rosor.—*Dan.* Edikerose.—*Russ.* Rosa Franshizskaia ; Rosa kasnaia.

Rosa gallica figured in Nees von E. 303.—Hayne, xi. 30.—Steph. and Ch. iii. 99.

THE *Rosa gallica*, the RED, FRENCH, or PROVINS ROSE, is a native of Austria, and other parts of the middle and south of Europe. The true Red rose of pharmacy is a variety, considered by some a distinct species, and called *Rosa provincialis*, which was probably introduced into Europe by the Crusaders, from its native country Barbary. The flower has a fine purplish red colour, and is scentless when fresh. The petals, its only officinal part, are used fresh for making a conserve, and are dried for other pharmaceutic purposes. They ought to be deprived of their whitish claws before desiccation; and they must be dried quickly, well sifted to remove insects and their ova, and subsequently kept in well-closed vessels. They retain their colour when dry, and then also acquire a roseate odour. They have an aromatic, bitterish, astringent, feebly acid

taste; which, together with their colour, is communicated to water. The infusion yields a black precipitate with the sesquioxide salts of iron.

The colour, taste, and other properties of the red rose are preserved, whether in the petals or in their infusion, by the addition of honey or sugar; and thus are formed the *Mel, Syrupus*, and *Conserva rosæ gallicæ.* The first, a very old remedy, is still used by some in sore throat and ulcerations of the lining membrane of the mouth. The syrup of the Edinburgh College is employed chiefly for imparting colour to mixtures, and is not much in use. The conserve is one of the best, if not the very best, of all materials for making pill-masses; which fact depends partly on its viscidity, but in part also on the peculiar obstinacy with which it retains moisture and continues soft, in consequence of which pills made with it may be kept long without becoming hard. The only other preparation, the *Infusum rosæ gallicæ*, is used both on account of its red colour, for making mixtures, and as a tonic, refrigerant and astringent, especially for compounding gargles, and as an addition to solutions of the neutral laxative salts. But the active properties it possesses depend mainly on the sulphuric acid it contains. The red rose is certainly astringent in itself, yet feebly so, and consequently it is seldom used alone on that account. It has been also thought laxative.

The dose of the *Infusum Rosæ gallicæ* is dr. i. ad dr. ii.—of the *Mel rosæ* dr. ii. ad dr. iv.

ROSAE FRUCTUS, *E.* ROSA CANINA, *L. D.* *Hip of Rosa Canina, L. W. DC. Spr., and of several allied species, deprived of the carpels* (Edin.). *Pulp of the fruit* (*The Fruit, D.*) *of Rosa Canina* (Lond. Dub.).

CONSERVA ROSAE FRUCTUS, E.

PROCESS, *Edin.* Take any convenient quantity of Hips, carefully deprived of their carpels; beat them to a fine pulp, adding gradually thrice as much sugar.

PROCESS, *Lond.* Take of

CONFECTIO ROSAE CANINAE, L.

Pulp of Rosa canina, a pound;
Bruised sugar, twenty ounces.
Beat the pulp gently in an earthen vessel, add the sugar gradually, and rub them to a uniform mass.

FIGURES of Rosa canina in Hayne, xi. 32.—Steph. and Ch. ii. 100.

THE *Rosa Canina*, or dog-rose, was not improbably the Κυνοϱοδον of the Greeks. It is a common ornament of hedgerows, roadsides, and neglected banks, in this country and most parts of the continent. In June and July it produces fine rose-red flowers of a faint agreeable odour, which are succeeded by an ovate, scarlet or crimson fruit, called Hip. The fruit, its only officinal part, is scentless, but possesses a rather pleasant sharp sweetish taste, which is increased by the action of frost. Other allied species are probably resorted to in collecting the officinal hip. It consists of the developed tube of the calyx, enclosing within its cavity numerous carpels or true fruits. These must be carefully removed before it is used for

pharmaceutic purposes. When thus cleared and then dried, it consists of 30.6 per cent of uncrystallizable sugar, 25 gum, 3 citric acid, and 8 impure malic acid, with various salts and a trace of wax, resin, and volatile oil (Biltz).

Its properties are preserved by beating the pulp with sugar. The conserve thus obtained is a useful material for making pill-masses; because, like the conserve of red-roses, it is tenacious, and continues long soft even under exposure to the air,—a property which it communicates to pills made with it. It is usefully substituted for conserve of red-roses, when the pill-mass contains a preparation of iron, as there is less tannin in it.

ROSMARINUS, *E. L. D.* *The tops of Rosmarinus officinalis, L. W. Spr.* *Rosemary.*

OLEUM ROSMARINI, E. L. D.

PROCESS, *Edin. Lond. Dub.* To be prepared according to the general directions for obtaining volatile oils. See *Introduction.*

SPIRITUS ROSMARINI, E. L. D.

PROCESS, *Edin.* Take of
Rosemary, two pounds and a-half. Proceed as for spirit of Lavender.

PROCESS, *Lond.* Take of
Rosemary-oil, two drachms;
Rectified-spirit, a gallon;
Water, a pint.
Mix and distil off a gallon with a gentle heat.

PROCESS, *Dub.* Take of
Fresh rosemary-tops, one pound and a-half.
Proof-spirit, a gallon (old-wine).
Distil off five pounds with a gentle heat.

FOR. NAMES.—*Fren.* Romarin.—*Ital.* Rosmarino; Ramerino.—*Span.* Romero.—*Port.* Alecrim.—*Ger.* Rosmarin.—*Dut.* Rozemarijn.—*Swed.* and *Dan.* Rosmarin.—*Russ.* Rozmarin aitetschnoi.—*Arab.* Hasalban achsir.

FIGURES of Rosmarinus officinalis in Nees von E. 162.—Hayne, vii. 25.—Steph. and Ch. i. 24.

THE ROSEMARY was probably the Λιβανωτις of the Greeks. It is the Rosmarinus of the Romans, and the *Rosmarinus officinalis* of the botanical system. It is a handsome evergreen shrub about six feet in height, and belongs to the Linnæan class and order *Diandria Monogynia*, and to the Natural family *Labiatæ*. It is a native of the countries surrounding the Mediterranean, and is cultivated in every garden for its beauty and fragrance. It produces clusters of bluish-white flowers in April and May; at which period the tops, its officinal part, should be gathered. They have, like the entire plant, a bitter, aromatic taste, and a powerful, diffusive, camphoraceous odour, which is readily communicated to water or spirit distilled from them. The source of the odour of rosemary is a volatile oil, which may be obtained by distillation with water, in the proportion of an eightieth of the plant. When this oil is long exposed to the air, a part evaporates, and about a sixteenth of its weight is left, which is a variety of stearoptin considerably resembling camphor. Rosemary-oil is much subject to adulteration with oil of turpentine. But the fraud is easily detected, for the pure oil is entirely soluble in its own volume of rectified-spirit,

while oil of turpentine is feebly soluble, and consequently separates when the mixed oils are agitated with that fluid.

Rosemary is much used in perfumery, and forms a principal part of the noted Hungary water. Like other *Labiatæ* it is a stimulant antispasmodic. But it is now little used in regular practice, and chiefly for aromatising ointments, liniments, and embrocations. It forms, in the shape of the *Spiritus rosmarini*, a part of the *Linimentum ammoniæ compositum* of the Edinburgh Pharmacopœia, one of the best of stimulant embrocations.

The doses of its preparations are *Spiritus rosmarini*, m. xxx. ad dr. i.—*Oleum rosmarini*, min. ii. ad min. v.

RUMEX, *L.* RUMEX ACETOSA, *D.* *Leaves of Rumex Acetosa, L. W. Spr. Common Sorrel.*

RUMEX AQUATICUS, *D.* *Root of Rumex aquaticus. Smith. Great-water-dock root.*

For. Names.—*Rumex Acetosa.*—*Fren.* Oseille.—*Ital.* Acetosa.—*Span.* Acedera. *Port.* Azedas.—*Ger.* Gemeine ampfer; Sauerampfer.—*Dut.* Veld zuuring.—*Swed.* Angsyra.—*Dan.* Engsyre.—*Russ.* Konnevoi schavel.

Figures of Rumex Acetosa in Nees von E. 112.—Hayne, xiii. 6.

Figure of Rumex aquaticus in Hayne, xiii. 4.

The roots and leaves of various species of *Rumex* have been immemorially used in medicine, but are now almost abandoned in British practice. They belong to the Linnæan class and order *Hexandria Monogynia*, and to the Natural family *Polygonaceæ*. Several species, and among these the two which are officinal, *R. Acetosa* and *R. aquaticus*, are common inhabitants of the British islands. The latter, which is met with in streams and ditches, has a large, branchy, astringent root, at one time in use for making antisyphilitic and alterative diet-drinks, but now wholly neglected. The former, the common sorrel of the fields, is still sometimes employed for making acid drinks in febrile complaints. Its leaves have a pleasant and powerful acidity, which they owe to binoxalate of potash. Till a few years ago they were the principal source of this salt and of its acid; but they are in no request now on that account, as both the salt and the acid may be obtained much more cheaply from other sources.

Both species of *Rumex* might be expunged from the British Materia Medica, and have been omitted in the last edition of the Edinburgh Pharmacopœia.

RUBIA TINCTORUM, *D.* *Root of Rubia tinctorum, L. W. DC. Spr. Madder.*

For. Names.—*Fren.* Garance.—*Ital.* Robbia.—*Span.* Granza; Rubia de tintoreros.—*Port.* Ruiva; Grança.—*Ger.* Krapp; Färberöthe.—*Dut.* Meekrap.—*Swed.* and *Dan.* Krap.—*Russ.* Mariona.—*Arab.* Fuh.—*Pers.* Runas.—*Tam.* Manjtittie.—*Hind.* Munjith.

Figures of Rubia tinctorum in Nees von E. 255.—Hayne, xi. 4.

MADDER was used by the Greek physicians under the name of Ερυθροδανον, and was long a standard emmenagogue in modern medicine. But as it is now wholly abandoned in the practice of the present day, and has been expunged from every recent edition of the British Pharmacopœias, it seems unnecessary to take that full notice of it in the present work, which otherwise its important chemical properties and applications to the arts would demand.

It is the root of *Rubia tinctorum*, a native of the south of Europe and the Levant, and extensively cultivated for the use of the dyer in various parts of the continent. It belongs to the Linnæan class and order *Tetrandria Monogynia*, and gives its name to the Natural family *Rubiaceæ*. It is imported largely into this country from the Levant, Holland, and the south of France. It contains a variety of colouring principles, probably not less than five, namely a brown, orange, yellow, purple and red principle (Robiquet). Of these the most important in relation to the art of dyeing is the red principle called Alizarin, which is crystalline, and forms splendid violet solutions with the alkalis.

Madder is promptly absorbed when it is taken internally, and soon tinges not merely the various secretions, but likewise the substance of the bones. It ranks as a tonic, diuretic, emmenagogue, and anti-rachitic; but it has probably little energy in any of these respects.

RUTA, *E. L. D.* *Leaves (and unripe fruit, E.) of Ruta graveolens, L. W. DC. Spr.* *Rue.*

RUTAE OLEUM, *E. D.* *Volatile oil of Ruta graveolens, &c. Oil of Rue.*

CONSERVA RUTAE, D. CONFECTIO RUTAE, L.

PROCESS, *Lond. Dub.* Take of
Rue leaves dried;
Carraway and
Laurel berries, of each 1½ ounce;
Sagapenum, half an ounce;
Black-pepper, two drachms;
Clarified honey, sixteen ounces.
Bruise the solids to a fine powder, and add the honey (whenever the confection is wanted, L.)

EXTRACTUM RUTAE, D.

PROCESS, *Dub.* To be prepared according to the general direction for making extracts. See *Introduction*.

OLEUM RUTAE, E. D.

PROCESS, *Edin. Dub.* To be prepared according to the general directions for making Volatile oils. See *Introduction*.

FOR NAMES.—*Fren.* Rue.—*Ital.* Ruta.—*Span.* Ruda.—*Port.* Arruda.—*Ger.* Raute; Gartenraute.—*Dut.* Ruite; Wijnruit.—*Swed.* Winruta.—*Dan.* Rude.—*Russ.* Ruta.—*Arab. Pers.* and *Tam.* Arooda.—*Hind.* Saturee.

FIGURES of Ruta graveolens figured in Nees von E. 376.—Hayne, vi. 8.—St. and Ch. ii. 71.—Roque, 116.

THE modern Rue is thought to have been the Πηγανον of the ancient Greek physicians, of which two varieties, the Π. αγριον and

Π. ʼορεινον, the wild and garden rue, were in great request for many medicinal purposes.

Natural and Chemical History.—It is the *Ruta graveolens* of botanists, a small shrub, scarcely three feet high, indigenous in the south of Europe as well as Germany, and often cultivated in gardens in this country for the wants of domestic practice. It belongs to the Linnæan class and order *Decandria Monogynia*, and gives its name to the Natural family *Rutaceæ*. It is easily known by its pale green doubly-pinnate leaves, its clustered yellow flowers, its roundish, spotted, five-cornered capsule, and the heavy very peculiar odour of the whole herb when bruised between the fingers. It flowers in July and August. The leaves, the only officinal part recognized by the London and Dublin Colleges, are most odoriferous when the seed-vessels are well developed, yet still green; and this therefore is the right time for collecting them. The Edinburgh College however correctly adds the unripe fruit also, because the seed-vessel is covered with large oil-vesicles, which impart great activity to this part of the plant. The chief properties of rue, which depend on its oil, are nearly lost by drying the plant; so that the Colleges are wrong in directing the *Conserva rutæ* to be made with dry leaves. The fresh leaves and ovaries emit when bruised a strong, peculiar, oppressive odour, and they have a disagreeable, bitter, acrid taste. They yield by distillation with water about seven grains in the thousand of a yellowish, acrid, heavy-smelling volatile oil, the *Oleum rutæ*, which is their active constituent. The *Conserva* or *Confectio rutæ*, also in use, contains other drugs of similar properties to rue, but is a feeble preparation so far as rue is concerned. The *Extractum rutæ* of the Dublin College, being destitute of volatile oil, is of little use. What is sold in this country as oil of rue has frequently a very different odour from the true oil, and its real nature is unknown to me. The true oil of rue has the pure, intense, penetrating odour of the bruised seed-vessels.

Actions and Uses.—Rue is a stimulant and even irritant, an antispasmodic, anthelmintic and emmenagogue. It is locally a rubefacient, and may even cause blistering. Internally, in large doses, it would seem to be a narcotico-acrid poison (Helie). Though much prized by the ancients and earlier moderns, it is now little used in Britain, and scarcely ever in Scotland except in domestic practice. It probably does not deserve this neglect, being useful in ascarides and lumbricus,—serviceable, like other fetid volatile oils, in hysteria,—and as active in catamenial disturbances as other more esteemed emmenagogues. Some have thought its action to be so peculiarly directed on the uterus as to be capable of exciting menorrhagia, miscarriage, and inflammation.

The doses of its preparations are, *Conserva*, D. *Confectio*, L. *rutæ*, dr. i. ad dr. iv. *Rutæ oleum*, E. D. min. iii. ad min. v.

SABADILLA, *E. L.* *Fruit of Veratrum Sabadilla, Retz. Obs.*

W. Spr.—of Helonias officinalis, Don in Edin. Phil. Journ. 1832, *and probably of other Melanthaceæ* (Edin.) *Seeds of Helonias officinalis, Don, &c.* (Lond.) *Cevadilla.*

VERATRIA, *E. L.* *Impure alkaloidal principle of Cevadilla.*

TESTS, *Lond.* Not at all soluble in water, more so in alcohol, and most of all in sulphuric ether. Scentless, but bitter. Not to be administered rashly.

PROCESS, *Edin.* Take any convenient quantity of cevadilla; pour boiling water over it in a covered vessel, and let it macerate for twenty-four hours; remove the cevadilla, squeeze it, and dry it thoroughly with a gentle heat. Beat it now in a mortar, and separate the seeds from the capsules by brisk agitation in a deep narrow vessel. Grind the seeds in a coffee-mill, and form them into a thick paste with rectified spirit. Pack this firmly in a percolator, and pass rectified spirit through it till the spirit ceases to be coloured. Concentrate the spirituous solutions by distillation so long as no deposit forms; and pour the residuum, while hot, into twelve times its volume of cold water. Filter through calico, and wash the residuum on the filter so long as the washings precipitate with ammonia. Unite the filtered liquid with the washings, and add an excess of ammonia. Collect the precipitate on a filter, wash it slightly with cold water, and dry it, first by imbibition with filtering paper, and then in the vapour-bath. A small additional quantity may be got by concentrating the filtered ammoniacal fluid, and allowing it to cool.

Veratria thus obtained is not pure, but sufficiently so for medical use. From this coloured substance it may be obtained white, but at considerable loss, by solution in very weak muriatic acid, decolorization with animal charcoal, and re-precipitation with ammonia.

PROCESS, *Lond.* Take of
Cevadilla, bruised, two pounds;
Rectified-spirit, three gallons;
Diluted sulphuric acid,
Solution of ammonia,
Animal-charcoal, and
Magnesia, a sufficiency.

Boil the cevadilla with a gallon of spirit for an hour in a retort with a receiver. Pour off the liquor, boil the residue with another gallon of spirit as well as that which has distilled over, and pour off that liquor also. Repeat this again. Express the residue. Filter the liquors, distil off the spirit, and evaporate what remains to the consistence of extract. Boil this thrice or oftener in water acidulated with sulphuric acid, and evaporate the filtered liquors to a syrupy consistence. Add magnesia to this when cold, agitating occasionally; squeeze and wash. Repeat this twice or three times, dry what remains, digest it twice or thrice in rectified spirit with a gentle heat and filter. Lastly, distil off the spirit, and boil the residue for fifteen minutes in water acidulated with sulphuric acid, and mixed with animal charcoal. Filter the liquor, wash the charcoal, concentrate the liquors to a syrupy consistence, drop into it ammonia so long as any veratria is precipitated, separate this, and dry it.

FOR. NAMES.—*Fren.* Cevadille.—*Ger.* Sabadill-samen —*Dan.* Sabadille-korn. —*Russ.* Tschemeritschnik vshemornoi.

FIGURES of Helonias officinalis as Veratrum officinale in Hayne, xiii. 27.—Nees von E. Suppl. 4; and as Asagræa officinalis in Bot. Reg. June 1839, 33. —Of Veratrum Sabadilla in Nees von E. 48. Descourtils, Flore des Antilles, iii. 195.

CEVADILLA or SABADILLA was first mentioned by Monardes in 1572 as a vegetable production of the New World. Though used occasionally for the destruction of vermin upon the skin, it was scarcely recognized as an officinal substance till a few years ago when it was adopted as the most convenient article for preparing the alkaloid Veratria.

Natural History.—The Cevadilla of commerce was generally believed to be derived from the *Veratrum Sabadilla*, a plant of the

Linnæan class and order *Polygamia Monœcia*, and of the Natural family *Colchicaceæ* of Decandolle or *Melanthaceæ* of Lindley, which inhabits some of the West-Indian islands, and also Mexico (Descourtils). But Schiede in his travels in Mexico found the cedavilla of European commerce, which comes from that country, to be produced by a different plant of the same Natural family, inhabiting the eastern slope of the Andes in the province of Jalapa, and constituting a distinct species named *Veratrum officinale* by Schlechtendahl. Afterwards Mr Don referred the same plant to a new genus, and called it *Helonias officinalis*; and more lately Dr Lindley established for it a newer genus still, and termed it *Asagræa officinalis.* The two plants differ in the structure of their racemose fruit,—the capsules of which are crowded all around the stem in the *Asagræa officinalis*, while in the *Veratrum Sabadilla* they are few in number and attached on one side only of the stem, in consequence of the male flowers on the other side falling off as the hermaphrodites ripen their fruit. Comparing this single character with the fragments of racemes to be met with in the commercial drug, it would appear that Schiede's plant is the principal species; but from the close resemblance among many of the *Melanthaceæ* in the appearance and properties of their fruit, it is not improbable, as the Edinburgh College suggests, that the drug may be also in part derived from other allied species.

The Cevadilla-plant of Mexico (*Helonias* or *Asagræa officinalis*) has a longish-ovate bulb, which produces numerous long, linear, grassy leaves, and from amidst them a flowering stem between three and six feet in height, which becomes covered to the extent of a foot or more at the top with small, dingy-yellow (white, *Lindl.*) polygamous flowers, and subsequently with numerous tri-follicled capsules. The *Veratrum Sabadilla*, as cultivated by Descourtils at San-Domingo from Mexican seeds, has broad, ovate, plantagineous leaves, dark purplish-black flowers, and capsules situated only upon one-half of the circumference of the stem.—The officinal part of the plant, called Cevadilla from the resemblance of its raceme and capsules to the ear of barley (Cebada, *Span.*), consists of the tri-follicled fruit, each division of which is composed of a slender elastic membranous follicle, and from one to three black, shining, flat, shrivelled, winged, elastic seeds. The fruit bears some resemblance to the ripe fruit of monkshood.

Chemical History.—The seeds have a bitter, acrid, tingling taste, intense, permanent and disagreeable; and their powder excites violent sneezing and discharge from the nostrils. They yield their properties with difficulty to water, but readily to rectified-spirit. Meissner found them in 1819 to consist of various extractive matters, 25 per cent of fixed oil, 10 of resin, a peculiar fatty acid called Sabadillic or Cevadic acid (Pelletier and Caventou), various other unimportant constituents, and 0.6 of the alkaloid Veratria.

VERATRIA was discovered about the same time by Meissner in

the cevadilla, and by Pelletier and Caventou both in that seed and in the root of *Veratrum album.* It is most easily prepared from cevadilla; yet even then the process is troublesome. The formulas given for the purpose by the Edinburgh and London Colleges are similar in principle, however much they differ in details. The London process is impracticable, for want of sufficient directions for reducing the seeds to a state of fine division. For it gives no instructions for detaching the seeds from their follicles, in which they are always contained as met with in commerce, and it simply directs them to be bruised; which, from the elasticity of the capsules, cannot be accomplished. In the Edinburgh process, the details of which were furnished by myself, these defects are supplied. The subsequent steps consist essentially in forming a concentrated tincture,—decomposing this by water, which dissolves the salt of veratria, and separates resin, oil, and colouring matter,—and finally precipitating the veratria by ammonia. The alkaloid is not, while impure, so insoluble in water as it has been commonly represented; and therefore care must be taken not to use this fluid too freely in washing it upon the filters. Couerbe says a pound of cevadilla will yield a drachm of commercial veratria; but the product, to be so large, must be very impure. I have seldom got from a thousand grains of cevadilla above one grain of veratria, purified by animal charcoal, and so rendered perfectly white.

Officinal veratria is a grayish-brown, grayish-white, or nearly snow-white powder, of an overpowering, bitter, acrid taste, and so irritating to the nostrils, that it is scarcely possible to experiment upon it in any way without suffering from sneezing and mucous discharge from the nostrils. It is not altogether a pure alkaloid, even when decolorized; and contains two basic resinoid bodies and two analogous acrid alkaloids, called veratria and sabadillina, the former of which is uncrystallizable, but the latter crystalline (Couerbe). The officinal veratria is sparingly soluble in water, but readily soluble in alcohol, ether, and especially weak acids; the last of which it neutralizes. Its solutions in acids are decomposed by alkalies, and veratria is precipitated. According to Couerbe the elementary composition of pure veratria is $C^{34}H^{22}O^{6}N$, and that of sabadillina $C^{20}H^{13}O^{5}N$.——On account of its very high price, and the want of well defined external characters, the veratria of the shops is very subject to adulteration; in one sense of the term it is always more or less adulterated, that is, with colouring matter; and there is unfortunately no good criterion for ascertaining its degree of purity.

Actions and Uses.—Veratria is in action one of the most energetic of irritant poisons, producing externally subcutaneous cellular inflammation if applied in large doses, and internally violent gastro-enteritis. Small doses injected into the veins cause fatal tetanus. When applied outwardly in small proportion mixed with lard, it excites a singular sense of heat and prickling in the part,

unattended in general with redness or vesication; and occasionally headache, nausea, griping, slight diarrhœa, and depression of the heart's action supervene. When taken internally in medicinal doses, it causes heat in the mouth, nausea and warmth in the stomach, sometimes diarrhœa, sometimes diuresis, often headache, and often also feebleness and retardation of the pulse.——It was first recommended in 1834 by Dr Turnbull, chiefly in the form of liniment, for tic douloureux, sciatica, hemicrania, and other neuralgic diseases, for subacute rheumatism, functional irritability of the heart, partial and general palsies, and general as well as local dropsies. Doubts however are entertained by many of its utility in any of these diseases, and most of those who think it serviceable limit its application to cases of neuralgia. I have received many communications from friends in testimony of its efficacy in neuralgic affections, when given inwardly, as well as outwardly. Others have been by no means so successful; and my own experience is also on the whole unfavourable. But in one inveterate case of neuralgic headache its efficacy was complete and immediate. It is usually applied externally in the form of ointment with forty times its weight of lard; and a mass of this ointment about the size of a field-bean is diligently rubbed into the skin over the affected part twice or thrice a-day. Internally it is given to the extent of a sixth of a grain in the form of pill.

It is worthy of remark, that, if veratria should eventually prove deserving of a permanent place in the Pharmacopœias, certain galenical preparations of cevadilla might be added, as being more simple and probably not less effectual. For cevadilla seeds possess great energy, and their active principle enjoys over the crude drug none of the advantages possessed by many other alkaloids in respect to uniformity of power or freedom from impurity. It is said to be a good vermifuge, even in tapeworm, and to be used in St Domingo as an emetic (Descourtils).—The best forms would probably be an alcoholic extract for internal use, and for external application an ointment made by uniting with lard the concentrated tincture obtained in the course of the Edinburgh process for veratria. The powder of cevadilla, though long used on the continent for killing vermin on the skin, is unsafe, especially with children.

SABINA, *E. L.* JUNIPERUS SABINA, *D.* *Tops* (*leaves, D.*) *of Juniperus Sabina* (*both fresh, and dried, L.*) *L. W. Spr. Savin.*

CERATUM SABINAE, E. L. UNGUENTUM SABINAE, D.

PROCESS, *Edin. Lond. Dub.* Take of
Fresh savin (bruised, L. D.) two parts;
Bees' wax, one part;
Axunge, four parts.

Edin. Lond. Melt the lard and wax together; add the savin (and boil till the leaves become friable, E.); strain through linen or calico.

Dub. Boil the leaves in the lard till they become crisp, strain, express, add the wax, and melt them together.

OLEUM SABINAE, E. D.

PROCESS, *Edin. Dub.* To be prepared from Savin according to the general directions for Volatile oils. See *Introduction.*

FOR. NAMES.—*Fren.* Sabine.—*Ital. Span.* and *Port.* Sabina—*Ger.* Sadebaum; Sagebaum.—*Dut.* Sevenboom.—*Swed.* Säfvenboom.—*Dan.* Sevenbom.—*Russ.* Moggevelnick donskoi; Sabina.

FIGURES of Juniperus Sabina in Nees von E. 87.—St. and Ch. iv. 141.—Roque, 179.

SAVIN was the Βραθυς or Βαροθρον of the Greek physicians, and *Sabina* of the Romans; and it has been used more or less in medicine since their times.

Natural History.—It is a native of the south of Europe and of Asiatic Russia, but thrives under cultivation in this country. It belongs to the Linnæan class and order *Diœcia Monadelphia*, according to Willdenow and Smith, and to the Natural family *Coniferæ.* It is a fine evergreen shrub, sometimes disposed to spread horizontally, sometimes rising erect to the height of eight or ten feet. It flowers in April or May; and its fruit, a dark purple berry of the size of a currant, ripens in autumn. The officinal part is the young tops, or, as the Dublin Pharmacopœia somewhat incorrectly states, the leaves. In this country the tops are usually collected for use in May. The twigs are densely covered with minute, imbricated, appressed leaves in four rows. They have a strong, peculiar, rather unpleasant odour, especially when bruised, and a disagreeable bitter, resinous, acrid taste; and these properties are in part retained when the twigs are dried.

Chemical History.—Savin imparts its properties to water, spirit, and fixed oils. The watery infusion has the odour and taste of savin, and becomes deep-green with the sesquioxide salts of iron. Oil or lard heated with the tops acquires their properties. The Pharmacopœias contain a preparation of this kind, the *Ceratum* or *Unguentum Sabinæ*, which is made by boiling the tops in axunge till they become crisp. As a strong savin odour is emitted during the process, it is probable that the temperature directed to be employed is too high; and that a gentler heat, with constant stirring, will make a more energetic cerate. This cerate is sometimes incorrectly made by simply triturating powder of dry savin with the unctuous matters in a state of fusion; but when made in this way, it is irregular and often too acrid. The tops and leaves of savin contain a little tannin; but their only active and important ingredient is a volatile oil, the *Oleum Sabinæ* of the Pharmacopœias, which may be obtained by distillation with water to the amount of about three per cent of the tops. This oil is yellowish, and possesses intensely the peculiar odour, and bitter acrid taste of the tops. It is a pure hydro-carbon, composed, like pure oil of turpentine, of ten equivalents of carbon and eight of hydrogen (Dumas).

Savin is sometimes confounded with the tops of *Juniperus Virginiana* of North America, a plant which possesses the same pro-

perties, and in its native country is used for the same purposes. The older leaves of this species are more spreading than in the true savin plant, and they are commonly arranged in three rows; but the tops are with difficulty distinguished, as their leaves are generally appressed, often four-rowed, and not unlike savin in odour. The substitution of the one for the other is probably of no great consequence.

Actions and Uses.—Savin is an irritant, stimulant, diaphoretic, diuretic, anthelmintic, and emmenagogue. As an irritant it is in large doses a powerful poison, producing when swallowed violent inflammation of the bowels. Six drachms will kill a dog if retained in the stomach. On account of the same irritant property it is employed externally, in the form of powder with an equal weight of verdigris, for destroying venereal warts, or in the form of cerate for stimulating indolent ulcers, and more generally as an issue-ointment for maintaining a discharge from blistered surfaces. Though in common use for the last purpose, savin cerate is more uncertain than is desirable, probably because the active constituent of the plant, its volatile oil, is apt to be driven off in part by the high heat at present directed to be employed in preparing it. Savin is not now much used as an internal remedy in regular practice; nevertheless its anthelmintic and emmenagogue virtues deserve attention. Its emmenagogue properties, long confided in, and upheld by Dr Francis Home, have for some time been distrusted on account of its poisonous tendency; but they have been recently again commended in strong terms by Dr Pereira. The latter author uses an infusion in sixty-four parts of water, or more generally the volatile oil in some mucilaginous vehicle, and says he has never met with any of the unpleasant irritant effects on the bowels and kidneys, so generally dreaded by practitioners.——This drug is believed by the vulgar to possess the power of inducing miscarriage, and is sometimes used by them for perpetrating this crime. But it cannot act in such a way without violently affecting the stomach and bowels, and so bringing life into extreme danger.

The doses of its preparations are: *Pulvis Sabinæ* gr. x. ad gr. xv.—*Oleum Sabinæ* min. ii. ad min. v.—and of Dr Pereira's infusion fl.dr. iv. ad fl.unc. i.

SACCHARUM, *L.* SACCHARUM PURUM, *E.* SACCHARUM PURIFICATUM, *D.* *Pure sugar* (*Edin.*); *Prepared juice* (*Lond.*),—*Concrete juice* (*Dub.*), *of Saccharum officinarum, L. W. Spr.*—*Sugar: White Sugar.*

SACCHARUM COMMUNE, *E.* SACCHARUM NON PURIFICATUM, *D.* *Impure sugar* (*Impure concrete juice, D.*) *of Saccharum officinarum, L. W. Spr.*—*Muscovado.*

SACCHARI FÆX, *E. L.* SACCHARI SYRUPUS EMPYREUMATICUS, *D.* *Concentrated uncrystallizable juice*

(Edin.),—*Prepared juice (Lond.)*,—*Empyreumatic syrup (Dub.)*, *of Saccharum officinarum, &c. Molasses.*

SYRUPUS, L. SYRUPUS SIMPLEX, E. D.

PROCESS, *Edin. Lond.* Take of
(Pure, E.) Sugar, ten pounds;
Water, three pints.
Dissolve the sugar in the water with the aid of a gentle heat.

PROCESS, *Dub.* Take of
Pure sugar, in fine powder, twenty-nine ounces;
Water, a pint (old-wine measure).
Add the sugar gradually to the water; digest with a gentle heat and occasional agitation in a close vessel till the sugar be dissolved; and pour off the liquid from any sediment that may form.

FOR. NAMES.—*Fren.* Sucre; Sucre de canne.—*Ital.* Zucchero.—*Span.* Azucar.—*Port.* Assucar.—*Ger.* Zucker.—*Dut.* Suiker.—*Swed.* Socker.—*Dan.* Sukker.—*Russ.* Sachar.—*Arab.* Sukhir.—*Pers.* and *Beng.* Shukkir.—*Tam.* Sakkara.—*Hind.* Cheene.

FIGURES of Saccharum officinarum in Nees von E. 33, 34, 35.—Hayne, ix. 30, 31.—Steph. and Ch. iv. 148.

CANE-SUGAR has been known immemorially in China and Hindostan. The ancient Greeks probably were acquainted with this among other sweet substances; for Dioscorides would seem to describe it when he speaks of his Σακχαρον μελιτος being "a concrete honey, like salt in appearance and brittleness, and found in reeds growing in India and Egypt." It was very little employed however in ancient times in Europe, and scarcely indeed came into use there till the period of the crusades; nor did it become a common article of food till after the discovery of the New World, and the transplantation of the sugar-cane to the West-Indian islands.

Natural History.—Sugar, identical with that of the cane, may be obtained from a great variety of plants. It is actually prepared on a scale for consumption in France from the *Beta vulgaris* or beet-root, in Canada from the *Acer saccharinum* or sugar-maple, in Ceylon and elsewhere from the *Cocos nucifera* or cocoa nut tree as well as other palms, in Italy from the *Sorghum saccharatum* or sweet sorgho, in China from the *Saccharum Sinense*, in Tahiti and the West-Indies from the *Saccharum violaceum*, and in many other parts of the world from the *Saccharum officinarum*. All the sugar used in Britain for medicinal and other purposes is prepared from the last two plants; which are often considered by botanists as mere varieties of a single species, the *S. officinarum*. This plant belongs to the Linnæan class and order *Triandria Digynia*, and to the Natural family *Graminaceæ*. It is now so widely spread over the hot parts of Asia, Africa, and America, that its native country cannot be discovered; but it is supposed to have come originally from the East. It has a perennial root, forming an intricately twisted turf; and it produces an annual stalk towards two inches in diameter, from six to twelve feet in height, jointed, solid, cellular, juicy, and of a green, yellow, red, purple, or striped colour externally. The stalk produces long grass-like leaves in two rows, and is prolonged into a flowering peduncle from two to five feet tall, whose terminal end forms a splendid pyramidal panicle of silver-gray flowers.

The best canes for sugar are those which have not flowered, or which, on account of some peculiarity resulting from cultivation, show no tendency to flower at all. The part of the cane most rich in sugar is the lower part of the stalk, from which the leaves have dropped off. The stalk contains about half its weight of a sweet pale-greenish juice, very prone to ferment. It has been often analyzed. Proust found it to consist chiefly of crystallizable and uncrystallizable sugar, malic acid, extractive matter, gum, and chlorophyll. Avequin got from 1000 parts of the juice of two varieties cultivated in Louisiana, besides albumen, gum, and salts, 113.55 and 119.05 of crystallizable sugar—46.34 and 48.95 of uncrystallizable sugar—and 898.23 and 894.98 of water. M. Plagne represents the juice of the sugar-cane as consisting of 783 parts of water, 208 crystallizable sugar, 7.5 uncrystallizable sugar, 0.07 cerin, 0.25 green wax, 0.4 a peculiar organic principle, and 0.07 albumen (= 999.27), besides salts, differing according to the nature of the soil.

In the manufacture of sugar, the first step is to express the juice by passing the canes between rollers. As it begins to ferment in a few minutes and to form acid, probably the acetic, it must be subjected promptly to evaporation in order to obtain sugar. For this purpose its free acid is first saturated with lime, otherwise the crystallization of the sugar would be interfered with. The juice is then duly concentrated; upon which a crystallization of brownish grains takes place after cooling. These grains constitute the Brown sugar, Raw sugar, or Muscovado of commerce, the *Saccharum impurum* or *non purificatum* of the Pharmacopœias. Six pounds of juice in the East Indies, and eight pounds in the West Indies, yield one pound of raw sugar. This is afterwards purified, chiefly in Europe, by elutriation with a little water, solution in water heated by steam, clarification with blood and alumina, filtration through animal charcoal, concentration in vacuo at 150°, crystallization, and displacement of the impure syrup in the crystalline mass by passing pure syrup through it (Howard). The product is the White sugar, Loaf sugar, or Refined sugar of the grocer, the *Saccharum purum* of the Pharmacopœias,—of which 79 per cent may be obtained from good Muscovado. In the process of crystallizing Muscovado for the first time from cane-juice, a considerable quantity of brown, slightly empyreumatised syrup is left, which is called Molasses or Treacle, and which shows no natural tendency to undergo crystallization. But processes have lately been devised by which this residuum may be made to yield more crystalline sugar; and, what is of more moment, precautions have been discovered, especially for moderating the heat during the first process of concentration, in consequence of which the proportion of molasses may be materially lessened, and Muscovado produced not merely in more abundance, but likewise of greater purity.

Chemical History.—PURE SUGAR is usually sold in compact, crystalline, conical loaves, which are snow-white, dry, easily pulverizable, free of odour, and of an intense sweet taste, without any aroma. Its density is 1.5629 according to Dr Thomson. It crystallizes in oblique four-sided prisms, terminated by two converging planes, or in derived figures. In this form it contains 5.3 per cent of water of crystallization. A gentle heat fuses it; at a higher temperature it swells and emits the peculiar odour of caramel; and at a red heat it burns with a vivid white flame. When subjected to dry distillation it yields water, pyromucic acid, carbonic acid, and carburetted-hydrogen (Cruickshanks). Water at 212° dissolves any quantity of sugar, and at 60° more than twice its weight. The latter solution is a thick viscid fluid, the *Syrupus* or *Syrupus simplex* of the Pharmacopœias. This is best prepared by dissolving the purest sugar in water heated rather below 212°. If a turbid syrup be obtained, it may be clarified by mixing with it while cold a little white of egg beat up with water, and boiling the whole till the scum rises to the surface. Syrup is prone to undergo decay and become mouldy. To prevent this change, various methods have been proposed, of which the most practicable and effectual is to preserve the store of syrup as much as possible in a place where the temperature does not exceed 50°. A late suggestion for preserving it, by adding along with the cane-sugar about a thirtieth of its weight of sugar of milk, may be of use to prevent vinous fermentation, but does not impede mouldiness in the trials I have made. Sugar is soluble in about twelve parts of rectified-spirit, and only in eighty parts of alcohol. Nitric acid converts it into oxalic and oxalhydric (saccharic, Liebig) acids, and chlorine into oxalhydric acid alone. Sulphuric and muriatic acids, when diluted, convert it successively into grape-sugar, uncrystallizable sugar, ulmic acid, and formic acid (Malagutti). Some vegetable acids, such as oxalic, tartaric, citric, malic, and acetic acids, and probably several others, prevent it from crystallizing from its watery solution, and seem to induce similar changes to those effected by mineral acids. Sugar combines with the alkalis, losing its sweet taste; and it unites with various metallic oxides, rendering them soluble. When distilled with lime, it yields a volatile liquid called Acetone, and an oily substance termed Metacetone (Fremy). According to the deductions of Dr Thomson, founded on various recent analyses, sugar is composed, in the anhydrous state, of 44.44 per cent of carbon, 6.18 of hydrogen, and 49.38 of oxygen, or 12 equivalents of the first, and 10 of each of the two other elements ($C^{12}H^{10}O^{10}$): and its crystals contain an equivalent more of water ($C^{12}H^{11}O^{11}$). But according to the latest analysis by Peligot, its composition, when free of water, is represented by the formula ($C^{12}H^{9}O^{9}$). A watery solution of sugar, when exposed with yeast to a temperature between 50° and 80°, undergoes fermentation; and the sugar produces alcohol and carbonic acid. Grape-sugar, in its anhydrous

state, is so constituted ($C^{12}H^{12}O^{12}$), that in the process of fermentation its elements undergo simple conversion into alcohol and carbonic acid ($2C^4H^6O^2 + 4CO^2$). But cane-sugar, even in its crystallized or hydrated state, contains one equivalent too little of water ($C^{12}H^{11}O^{11}$) for undergoing the same change. Hence the fermentation of cane-sugar is not a case of simple conversion of elements into new compounds, and water must take part in the phenomena. This inference from the constitution of cane-sugar is proved by the weight of the products of its fermentation. The carbonic acid and alcohol produced from grape-sugar, are, together, exactly equal in weight to the anhydrous sugar employed (Guerin Varry). In the case of cane-sugar, one hundred parts yield 51.27 of carbonic acid, and 52.62 of alcohol, or 103.89 in all; which amounts very nearly to the weight of one equivalent of water in addition to every equivalent of sugar. In the process of fermentation, the yeast does not supply any thing towards the constitution of the new products.

RAW-SUGAR of good quality is in small shining grains, which are short, broken, four-sided prisms, varying in colour from very pale yellowish-gray to rather deep yellowish-brown, dry when recent, but afterwards somewhat clammy, of a purely sweet taste, and of a feeble honey-like odour. The purest I have seen comes from Demerara. Raw-sugar contains besides colouring-matter, a trace of the lime used in neutralizing the natural acid of the cane-juice; and in consequence a small portion of it is apt to pass by slow action of the lime into the state of gum (Daniell), which renders it adhesive and clammy.

MOLASSES constitutes a thick ropy syrup about the density 1400, dark brownish-black in colour, of a peculiar sweet rather empyreumatic odour, and of a corresponding not unpleasant taste. It consists chiefly of gummy extract, and uncrystallizable sugar; but part of its sugar may be made to crystallize. It undergoes fermentation like pure sugar, when similarly treated. It retains its moisture with great tenacity, so that it thickens very slowly under exposure to the air.

Other forms of sugar from the sugar-cane may be here mentioned, although not used in medicine. These are Barley-sugar and Sugar-candy. The former is made by evaporating syrup to a state of great concentration without empyreumatizing it, and then allowing it to cool; upon which it concretes into a homogeneous, transparent, glassy-like substance, varying in colour with the purity of the sugar used and with the skill of the manufacturer. Sugar-candy is formed by adding spirit to concentrated syrup at a moderate heat, and letting the liquid cool with strings suspended in it to which the crystals attach themselves. The product is colourless or yellowish-brown, according to the purity of the sugar; and it is hydrated sugar, in well-formed rhombic prisms or some derived form.

Adulterations.—The adulterations of sugar are said to be numerous; but it is easily obtained pure in this country. The most important sophistications are the admixture of pure sugar with lime, or with the natural impurities which constitute raw sugar, and which are principally gum and a trace of tannin. Lime is detected in the solution by a white precipitate being caused by oxalate of ammonia, gum by a white precipitate arising on the addition of diacetate of lead, and tannin by a black coloration or precipitate appearing under the action of sulphate of sesquioxide of iron. The admixture of cane-sugar with grape-sugar, or with the sugar obtained by the action of sulphuric acid on starch, may be detected, according to Trommer, by the action of sulphate of copper on a solution of the sugar in caustic potash. If the salt of copper be added cautiously so long as the potash redissolves the oxide which separates, a permanent blue fluid results in the case of pure cane-sugar, but if starch-sugar be present, the fluid loses its colour, and a red deposit of suboxide of copper slowly separates. It appears however that this reaction occurs with uncrystallizable cane-sugar (Soubeiran), and therefore is not a distinctive test of the presence of starch-sugar.

Actions and Uses.—Sugar is in its action nutritive, demulcent, and topically antiseptic. Doubts have been lately raised as to its nutritive quality by Dr Prout; but they rest chiefly on theoretical considerations. There can be no question of its being eminently nutritive when mingled with other alimentary proximate principles. It cannot be used however in large proportion without injury to digestion. It is a powerful antiseptic in relation to both vegetable and animal matters; the former of which may be preserved indefinitely in syrup, so long as the syrup is secured against fermentation; while the latter, after long immersion in the same fluid or in moistened sugar, may be perfectly mummified. Its uses in medicine are confined mainly to pharmacy, in which sugar itself, syrup, and treacle are most extensively employed for covering the taste of nauseous drugs, for suspending others in the form of mixture or emulsion, and for converting others into the state of conserve, confection, or electuary, and into those of pill and of lozenge. Few substances answer better in extempore prescriptions than syrup for making mixtures, or than treacle for making pills. For the latter purpose syrup, though in familiar use, is not so eligible, because the pill-mass speedily hardens. But treacle, owing to the tenacity with which moisture is retained by it, preserves them long soft, while its antiseptic properties prevent them from becoming mouldy. In these respects it is scarcely surpassed even by conserve of red roses (see *Rosa gallica*).

SAGAPENUM, *L. D.* *Gum resin* (*from an unascertained species of Ferula,* Lond.) *Sagapenum.*

PILULAE SAGAPENI COMPOSITAE, L.

PROCESS, *Lond.* Take of
Sagapenum, an ounce;
Aloes, half a drachm;
Syrup of ginger, a sufficiency.
Beat them into a uniform pill mass.

FOR. NAMES— *Fren.* Sagapenum.—*Ital.* Sagapeno; serapino.—*Span.* and *Port.* Sagepeno.—*Ger.* and *Dan.* Sagapen-gummi.

THE Σαγαπηνον of Dioscorides, a gum-resin "from a ferulaceous plant growing in Media," is in all probability the modern Sagapenum, now imported into Europe from the Levant.

Its botanical source is wholly unknown. The conjecture of Willdenow, that it may be produced by the *Ferula persica*, one of the sources of assafœtida, derives some plausibility from the circumstance, that the assafœtida of this species is admitted, by those who have travelled in Northern Persia, to be an inferior sort of the drug; and that commercial sagapenum has some resemblance in taste and odour to an inferior assafœtida. But there is no direct authority either for the specific reference suggested by that botanist, or for the generic reference laid down in positive terms by the London College.

Like other umbelliferous gum-resins, it occurs both in tears and amygdaloidal masses, but chiefly in the latter shape. The best of what is generally met with in commerce consists of semitransparent agglutinated tears, somewhat darker than galbanum, tenacious, easily softened with the heat of the hand, of an alliaceous odour, similar to that of assafœtida, but weaker, and of a corresponding alliaceous, acrid taste. An inferior sort is browner, softer, and uniform without any appearance of tears. It consists essentially, like the analogous products of umbelliferous plants, of resin, gum, and volatile oil, in the proportion, according to Brandes, of 50.3, 37.2, and 3.7 per cent; and the gum is composed chiefly of arabin, but partly of bassorin. The oil is light yellow, strongly alliaceous in odour, and in all probability the chief active principle of the drug.

Sagapenum possesses the stimulant, antispasmodic, and carminative virtues of the fetid gum-resins generally, and approaches closely in its effects to assafœtida. It is indeed so like an inferior assafœtida that it might be expunged from all the Pharmacopœias, as it has been already by the Edinburgh College. Meanwhile it forms part of the *Pilulæ sagapeni compositæ*, the *Pilulæ galbani compositæ* and *Conserva rutæ* of the English and Irish Colleges.

SAGO, *E. L. Farina from the interior of the trunk of various Palmaceæ and species of Cycas, L. W. Spr.* (Edin.) *Fecula of the pith of Sagus Rumphii* (Lond.) *Sago.*

FOR. NAMES.—The term Sago has been adopted in all modern European languages.

A GREAT number of palms, and several species of the allied fa-

mily *Cycadaceæ*, contain in the cellular structure within their stem an abundance of starch, which may be detached by bruising and elutriating the tissue containing it. The substance thence obtained is called Sago. Three species are known to produce fine sago, namely *Sagus lævis*, Jack, or *Sagus inermis*, Roxb., a native of Borneo and Sumatra,—*Sagus Rumphii*, Willd. or *Sagus farinifera*, Gaertner, a species common to Malacca and the adjacent islands,—and *Saguerus Rumphii*, Roxb., abounding in all the eastern isles of the Indian ocean. These plants are fine trees, often of great size, belonging to the Natural family *Palmaceæ*, and to the Linnæan class and order *Monœcia Hexandria*, or *Polyandria*. Sago is extracted from them by reducing the cellular structure in the interior of the trunk to powder, stirring this with water, straining the water, washing the starch which subsides, and giving it a powdery, granular, or pearly appearance by a variety of processes which have not yet been satisfactorily explained. A single tree of some species will yield no less than between five and six hundred pounds.

Three kinds of sago are met with in commerce, Sago-meal, Common Sago, and Pearl Sago. Sago-meal is powdery, of a pale yellowish-white or reddish-white colour, of a feeble, peculiar odour, and composed of unbroken starch-globules. Common sago is in roundish grains, of the size of pearl-barley or sometimes larger, mottled with various tints of gray and brown, and composed of aggregated, unbroken globules. These two varieties do not yield any soluble starch or amidin to cold water. Pearl sago is in pale-yellowish-white, reddish-white, grayish-white, or translucent grains, about the size of a pin's head, and of a somewhat pearly lustre externally. This variety has evidently been subjected to heat in the process for preparing it; because the starch-globules are broken up, so that cold water forms with it a solution which is rendered blue by tincture of iodine. All sagos contain more or less colouring matter, and are inferior to other familiar varieties of starch.

Sago partakes of the nutritive and demulcent properties of the pure amylaceous substances. It is a convenient and agreeable article for making puddings, gruel, and diet-drinks for the sick-room. Since the beginning of the present century it has been displaced however for such purposes by the purer arrow-root, tapioca, and tous-les-mois. Of late, in consequence of its having been very largely imported into Britain, it has come into use for feeding domestic animals, especially horses.

SALIX, *E.* SALICIS CAPREÆ CORTEX, *D.* *Bark of Salix Caprea, L. W. Spr.* *Round-leaved-willow-bark.*

SALICIS FRAGILIS CORTEX, *D.* *Bark of Salix fragilis, L. W. Spr.* *Crack-willow-bark.*

SALICIS ALBAE CORTEX, *D.* *Bark of Salix alba, L. W. Spr.* *White-willow-bark.*

For. Names.—*Fren.* Saule.—*Ital.* Salice ; Salico.—*Ger.* Weide.—*Dut.* Wilg. —*Swed.* Pihl.—*Dan.* Pijl.—*Russ.* Berba ; Betla.

Figures of Salix Caprea in Hayne, xiii. 43.—Engl. Bot. 1488.—Steph. and Ch. iii. 139. Salix fragilis in Hayne, xiii. 41.—Nees von E. 91—Engl. Bot. 1807. —Steph. and Ch. iii. 139. Salix alba in Hayne, xiii. 42.—Nees von E. Suppl. 17.—Engl. Bot. 2430.—Steph. and Ch. iii. 139.

Willow-bark has been long more or less used in medicine as a bitter tonic and astringent. But although undoubtedly so active in these respects as to be a tolerable substitute for other more familiar tonics, and even, as some think, for cinchona-bark itself, it has fallen so entirely into desuetude, that it would scarcely require mention here, except on account of its active principle, Salicin.

Natural History.—The willows belong to the Linnæan class and order *Diœcia Diandria*, according to Smith and Willdenow, and to the Natural family *Salicaceæ* of Lindley or *Salicineæ* of other botanists, a division separated from the great family *Amentaceæ* of Decandolle. The species are very numerous, and abound chiefly in the middle and northern parts of Europe. Every botanist knows that they are very difficult to distinguish from one another,—a circumstance in part explanatory of the opposite opinions that have been given of their virtues. The three officinal species, with many others, are natives of Britain. It is doubtful whether the Colleges have admitted the best of them into the Pharmacopœias. The sensible qualities of the *Salix fragilis* promise little for its activity; and according to Smith, the best British species is one not sanctioned by authority, the *Salix Russelliana,* which is often confounded, he says, with the former. There seems little question that the proper test for choosing the officinal species is the bitter taste, as Dr Pereira has suggested; for this quality depends on the salicin.

Chemical History.—The infusions and decoctions of willow-bark are bitter, astringent, and somewhat balsamic. The astringent property they owe to tannin, which causes them to yield a deep green precipitate or coloration with the sesquioxide salts of iron.

Salicin, their most important ingredient, was discovered by Buchner in 1828. It has been found in the bark of the *Salix Helix, purpurea, fragilis, Lambertiana, viminalis, alba, pentandra, polyandra, incana, fissa,* and *vitellina,* of which the seven first and the last are indigenous species. It has generally been obtained by precipitating the tannin from a strong decoction by means of lime, concentrating what remains to a syrup, throwing down the gummy matter with rectified-spirit, evaporating the residue sufficiently for crystals to form, and purifying these crystals in a state of solution in water by the action of animal charcoal. A more recent process has been given by Erdmann. Sixteen ounces of the bark of *Salix pentandra* are left for twenty-four hours to macerate in milk of lime consisting of two ounces of lime in four quarts of water; after which the mixture is boiled for half an hour. This step is repeated twice with the residue. The decoctions being cleared by

subsidence, and concentrated to a quart, the remaining liquid is digested with eight ounces of ivory-black, filtered, and evaporated to dryness. The extract in powder is then exhausted with spirit containing 28 per cent of alcohol, the spirit is distilled off, and the crystals which subsequently form are purified by a second crystallization after being treated with ivory-black. Sixteen ounces of bark yield five drachms.—Salicin when pure forms minute rectangular scales, very bitter, and somewhat aromatic, soluble in about twenty parts of temperate water, soluble also in rectified-spirit, but not so in ether. It is a neutral body. Concentrated sulphuric acid imparts to it a brilliant red hue, and acts in this way with such delicacy, that it may be used as a test for salicin in willow-bark (Pelouze). It does not contain azote. Its constitution in crystals is stated to be $C^{21}H^{11}O^{11}$ = anhydrous salicin $C^{21}H^{12}O^{9}+2$ Aq (Piria).

Actions and Uses.—Willow-bark is to be used as a febrifuge by infusing an ounce of the dried bark in a pint of water, and administering the infusion in the dose of one or two ounces frequently. Salicin has seemed a powerful febrifuge in doses of six grains and upwards in the hands of various physicians in France and elsewhere; and it merits a fuller inquiry as a substitute for cinchona and quina in the treatment of ague. According to various reports collected by Buchner, 12 grains in divided doses will generally arrest ague. As a tonic stomachic in dyspepsia, it is quite on a par with quina; and it is not apt, like quina, to cause congestion in the head when given in large doses.

SAMBUCUS, *E. L. D. Flowers (Berries and Bark, D.) of Sambucus Nigra, L. W. DC. Spr. Elder-flowers, &c.*

Aqua Sambuci, E. L.

Process, *Edin. Lond.* Take of Elder-flowers, ten pounds; or Elder-flower oil, two drachms; Water, two gallons; Rectified-spirit, three (proof-spirit seven, L.) fluidounces; Mix and distil one gallon.

Oleum Sambuci, L.

Process, *Lond.* To be prepared according to the general directions for Volatile oils. See *Introduction.*

Succus Spissatus Sambuci, D.

Process, *Dub.* To be prepared from fresh ripe elder-berries in the same way as inspissated juice of Aconite.

Unguentum Sambuci, D.

Process, *Dub.* Take of Fresh elder-leaves, three pounds; Prepared lard, four pounds; Prepared suet, two pounds; To be prepared in the same manner as ointment of Savin.

For. Names.—*Fren.* Sureau.—*Ital.* Sambuco.—*Span.* Sauco.—*Port.* Sabuguerio.—*Ger.* Gemeine hollunder.—*Dut.* Vlierboom.—*Swed.* Flaeder.—*Dan.* Hyld.—*Russ.* Buzina tschernaia.

Figures of Sambucus nigra in Nees Von E. 266.—Hayne, iv. 16.—Steph. and Ch. ii. 79.

The Elder is the Ακτη of Dioscorides. It is now put to little use.

It belongs to the Linnæan class and order *Pentandria Digynia*, and to the Natural family *Caprifoliaceæ*. It is a tall shrub or low tree, growing in hedge-rows in this and other European countries. It produces cymes of white, crowded, odoriferous flowers, which are succeeded by small deep-purple berries, whose taste is sweetish, acid, and allied in flavour to that of the Frontignan grape.

The flowers contain a small quantity of concrete volatile oil, and a minute proportion of a liquid oil of a penetrating diffusive odour (Pagenstecher), which may be obtained by distillation with water. The water charged with the oil is the *Aqua sambuci* of the Pharmacopœias, which some use for flavouring mixtures and emulsions. The inspissated juice of the berries, once in current employment under the old officinal name of *Rob sambuci*, possesses gently laxative and diuretic virtues. The inner bark, and probably also the leaves, produce both vomiting and brisk purging; and I have known the leaves cause severe irritant poisoning in a child. The source of its properties has not yet been traced.

Unless the elder possesses more energetic properties than it is at present believed to have, it may be expunged without detriment from the Pharmacopœias.

SAPO, *L.* SAPO DURUS, *E. D.* (*Spanish or Castile, E.*) *Soap, made with olive oil and soda.*

SAPO MOLLIS, E. L. D. (*Soft, E.*) *Soap, made with olive oil and potash.*

Ceratum Saponis, L.

Process, *Lond.* Take of
Soap, ten ounces;
Wax, twelve ounces and a half;
Powder of oxide of lead, fifteen ounces;
Olive-oil, a pint;
Vinegar, a gallon.
Boil the oxide in the vinegar with a gentle heat and constant stirring till they unite. Add the soap, and boil again in the same way till the moisture be all expelled. Then mix with these the wax previously melted with the oil.

Emplastrum Saponis, E. L. D.

Process, *Edin.* Take of
Litharge-plaster, four ounces;
Gum-plaster, two ounces;
Castile-soap shavings, an ounce;
Melt the plasters together with a gentle heat, add the soap, and boil for a little.

Process, *Lond. Dub.* Take of
Shavings of soap, half a pound;
Litharge (lead, L.) plaster, 3 pounds;
Melt the plaster, add the soap, and boil to the due consistence.

Emplastrum Saponis Compositum *vel* Adhaerens, D.

Process, *Dub.* Take of
Soap-plaster, two ounces;
Plaster of litharge and resin, 3 ounces.
Make a plaster, to be spread melted upon linen.

Linimentum Saponis, E. L. D.

Process, *Edin.* Take of
Castile soap, five ounces;
Camphor, two ounces and a half;
Oil of rosemary, six fluidrachms;
Rectified-spirit, two pints.
Digest the soap in the spirit for three days, add the camphor and oil, and agitate briskly.

Process, *Lond. Dub.* Take of
Soap, three ounces;
Camphor, an ounce;
Spirit of rosemary, 16 fluidounces;
Dissolve the camphor in the spirit; add the soap, and digest with a gentle heat to dissolve it (Lond). Dissolve first the soap and then the camphor (Dub.)

LINIMENTUM SAPONIS CUM OPIO, D. See *Opium*.

PILULAE SAPONIS COMPOSITAE, L. See *Opium*.

PILULAE SAPONIS CUM OPIO, D. See *Opium*.

FOR. NAMES.—*Fren.* Savon.—*Ital.* Sapone.—*Span.* Xabon.—*Port.* Savaõ.—*Ger.* Seife.—*Dut.* Zeep.—*Swed.* Silkeswäl.—*Dan.* Saebe.—*Russ.* Milo.—*Arab.* Saboon.—*Tam.* Nat sowcarum.

IN the arts a great variety of soaps are employed, which differ materially from one another in composition. But in medicine the finer qualities are alone used; and in the British Pharmacopœias two only are acknowledged, Hard and Soft Olive-soap, made by the action of soda and potash respectively upon olive-oil. At one time these soaps were imported for medical use into Britain from the countries where olive-oil is produced, and more especially from Spain; but of late the more important of them, hard olive-soap, has also been manufactured in England. Soft soap is scarcely made use of now in medical practice or in pharmacy, and might be omitted among officinal drugs without inconvenience.

Chemical History.—HARD SOAP may be obtained by the action of soda-ley on various oils, fats and resins. But the *Sapo durus*, or Hard soap of the Pharmacopœias, is the Spanish or Castile soap of common speech, prepared with olive-oil alone. The finest variety, and the only one admissible in medicine is the white kind; for the mottled variety so often met with, and by some even preferred to the former, is really impure, being coloured by means of sulphate and peroxide of iron (Dr A. T. Thomson). White Castile soap is of a pale grayish-white colour, quite dry, incapable of leaving an oily stain on paper, free of odour, not corrosive or alkaline to the taste, and entirely soluble both in water and rectified-spirit (Geiger). When heated, it is soft enough to assume any shape; but in warm dry air it gradually becomes horny-like, and so hard as to be pulverizable. Its watery solution is decomposed by acids, and insoluble fatty acids are disengaged. It is also decomposed by soluble salts of the earths and of most metals, double decomposition taking place in these instances, and insoluble salts or soaps of metallic oxides being formed. These reactions will be better understood on considering the preparation and composition of hard soap.

It is prepared by gently heating together olive-oil and a strong solution of causic soda, until combination takes place. It was long thought that the action of the alkali on the oil was a case of simple combination. But it has been proved by the researches of Chevreul on the composition of the oils and fats, and on the process of saponification, that the change is one of much greater complexity. Two views have been taken of the phenomena. The one, assuming the oils to be compounded of certain pure oleaginous principles, called stearin, margarin, and elaïn, supposes that these principles are converted by a new arrangement of their elements into two fatty acids, called oleïc and margaric acids, and a peculiar sweet prin-

ciple termed glycerin; and that the acids unite at the moment of formation with the soda to produce soluble fatty salts or soaps, while the glycerin is detached as a neutral body dissolved in the water. The other view, now generally adopted, supposes the oils and fats to be compounds of margaric and oleic acids with glycerin as a base, and consequently reduces the process of saponification to one of simple elective decomposition, in which the compound is resolved by the superior affinity of the alkali for the fatty acids pre-existing in the oil,—the alkali uniting with these acids, and the glycerin being set free. Castile-soap is therefore a compound of margarate and oleate of soda; and from analyses executed by Braconnot in France, and Ure in this country, it appears to contain from 9 to 10.5 per cent of base, between 68.4 and 76.5 of fatty acids, of which oleic acid is the most abundant, and from 14.3 to 21.4 of water.

Adulterations.—The adulterations of Castile-soap are numerous. Its white colour, freedom from odour, solubility in rectified-spirit, and incapability of imparting an oily stain to paper, will furnish evidence of the absence of all ordinary impurities.

Soft Soap, made of potash and animal oils or fats, is used in the arts, but not in medicine; and Dr Pereira found on inquiry at some of the principal soap-manufacturers in England, that no variety of it is ever made according to the definition of the Pharmacopœias. The subject therefore does not require consideration here. When prepared as the Colleges direct, soft soap consists chiefly of margarate and oleate of potash.

Actions and Uses.—Soap is internally antacid, antilithic, and in some measure laxative; and externally it is detersive. On account of its easy decomposition by acids, its alkali acts in some measure as if it were free. Hence soap in solution is a useful remedy for poisoning with the concentrated acids; but it is inferior in convenience to chalk, lime, or the bicarbonates of soda and of potash. Hence too, in urinary calculus and gravel it tends to correct the lithic diathesis; and during last century, because it was an important constituent of Stephens' nostrum for stone, it was even thought to possess the virtues of a lithontriptic. For these purposes too it is much surpassed by the alkalis, their carbonates, and more especially their bicarbonates. Accordingly soap is now abandoned as an internal remedy, and is used outwardly alone. It is a good detersive in cutaneous diseases. Few disorders of this kind are not benefited by regular ablution with soap and water; and for the slighter scaly or papular eruptions no other remedy is in general required than this. The chief use made of soap in medical practice, besides for purposes of cleanliness, is in pharmacy, for compounding pills, cerates, liniments and plasters. It is a good excipient for giving due consistence to the compound colocynth extract, to aloes, assafœtida, gamboge, and the like; and it imparts to liniments, plasters or cerates either due lubricity or

hardness. In such compounds it is not always a mere mixture that is produced. In the London *Ceratum saponis*, for example, the diacetate of lead formed in the first stage of the process is decomposed by the soap, and margarate and oleate of lead are produced. The *Linimentum saponis*, from its lubricity, is an excellent addition to most embrocations. The *Ceratum saponis* is a good application to strumous sores. The *Emplastrum saponis* is considered a discutient; and it communicates to resin-plaster that degree of pliability which fits it for being used upon linen in the form of adhesive plaster, the *Emplastrum saponis compositum*, or *adhærens* of the Dublin Pharmacopœia. A solution, of fixed strength, of soap in weak spirit is used for determining the amount of lime contained in waters for domestic use (Clark).

SARZA, *E. L.* SARSAPARILLA, *D.* *Root of Smilax officinalis, Humb. et Bonpl. Nov. Gen.—Spr.* (Lond.) *and probably of other species,* (Edin.)—*Root of Smilax Sarsaparilla, Linn.* (Dub.)—*Sarsaparilla.*

DECOCTUM SARZAE, L. E. DEC. SARSAPARILLAE, D

PROCESS, *Edin. Lond. Dub.* Take of
Sarsaparilla chips, 5 (4, D.) ounces;
Boiling (distilled, L.) water, four (old wine, D.) pints.
Digest the root in the water for two hours at a temperature somewhat below ebullition (near the fire in a lightly covered vessel, L.); take out the root, bruise, and replace it; (repeat the digestion for two hours, L.); boil down to two (old wine, D.) pints; and then squeeze and strain the decoction.

DEC. SARZAE COMPOSITUM, E. L. DEC. SARSAPARILLAE COMP. D.

PROCESS, *Edin. Lond. Dub.* Take of
Decoction of Sarsaparilla, boiling hot four (old wine, D.) pints;
Sassafras chips,
Guaiac turnings, and
Bruised liquorice-root, of each ten (eight, D.) drachms;
Mezereon (root-bark, D.), three (four, E.) drachms.
Boil for fifteen minutes and strain.

EXTRACTUM SARZAE, L. EXTRACTUM SARSAPARILLAE, D.

PROCESS, *Lond.* To be prepared in the same way as extract of *Gentian.*
PROCESS, *Dub.* Take of
Sarsaparilla chips, a pound;
Boiling water, a gallon.
Infuse for twenty-four hours; boil down to four pounds; strain the liquor while it is hot, and concentrate to the proper consistence.

EXT. SARZAE FLUIDUM, E. EXT. SARSAPARILLAE FLUIDUM, D.

PROCESS, *Edin. Dub.* Take of
Sarsaparilla chips, a pound;
Boiling water, six pints (twelve old wine-pints, D.)
Edin. Digest the root for two hours in four pints of the water; take it out, bruise, and replace it, and boil for two hours; filter and squeeze out the liquor; boil the residue in the remaining two pints of water, and filter and squeeze out this liquor also; evaporate the united liquors to the consistence of thin syrup; add, when the product is cool, as much rectified-spirit as will make in all sixteen fluidounces.—This fluid extract may be aromatized with volatile oils or warm aromatics.
Dub. Boil for an hour, pour off the liquor; boil again in as much water, pour off the liquor, and squeeze the residue strongly. Unite the liquors, let the impurities settle, boil down the liquor to thirty ounces, and add two ounces of rectified spirit.

INFUSUM SARSAPARILLAE COMPOSITUM, D.

PROCESS, *Dub.* Take of
Sarsaparilla, washed with cold water and then sliced, an ounce;
Lime-water, a pint (old wine-measure).
Macerate for 12 hours in a close vessel, shaking it occasionally, and strain.

SYRUPUS SARZAE, E. L. SYRUPUS SARSAPARILLAE, D.

PROCESS, *Edin. Lond. Dub.* Take of Sarsaparilla chips, fifteen (twelve, D.) ounces;
Boiling water, 1 (old wine, D.) gallon.
Infuse the sarsaparilla in the water for twenty-four hours; boil down to four (old wine, D.) pints, and strain the liquor while hot; add the sugar, and evaporate to the consistence of syrup. (Make a syrup in the usual way, D.)

FOR. NAMES.—*Fren.* Salsepareille.—*Ital.* Salsapariglia.—*Span.* Sarzaparrilla. —*Port.* Salsa-parrilha.—*Ger.* Sarsaparill; Sassaparille.—*Dut.* Sarsaparille. —*Swed.* Sassaparill.—*Dan.* Sarsaparil.—*Russ.* Sassaparel.

FIGURES of Smilax medica in Nees von E. Suppl. 7.—Smilax Sarsaparilla in Woodv. Med. Bot. 62.—Steph. and Ch. iv. 162.

SARSAPARILLA was introduced into Europe from the New World about the middle of the sixteenth century along with other drugs of anti-syphilitic name. Since that time it has continued to be used in European medicine, but with variable reputation. For some years past it has been in greater credit, in Britain at least, than perhaps at any previous period. Nevertheless, its pharmacology is obscure in all its branches.

Natural History.—It has been ascertained to be the root of a genus of creepers inhabiting moist river banks and woods in the hotter parts of North and South America, especially Mexico, Columbia, Guiana, and Brazil. The genus belongs to the Linnæan class and order *Diœcia Hexandria*, and to the Natural family *Smilaceæ*. The species are very numerous; and probably more of them are gathered for the supply of Europe than medical botanists have hitherto been able to determine with accuracy. Meanwhile, the following seem to be well made out as sources of the officinal drug. 1. *Smilax officinalis* of Humboldt and Bonpland, a species with smooth, prickly, angular stems, and smooth, coriaceous, cordate, ovate-oblong, acute leaves about a foot in length, was found by Humboldt and Bonpland in the woods near the Rio Magdalena in Columbia, where it is called Sarzaparilla, and whence the root is conveyed to the Port of Carthagena, to be shipped there for Jamaica and other parts. 2. *Smilax syphilitica*, of Willdenow, a round-stemmed species, prickly only at the knots of the stems, with oblong-lanceolate, leathery, shining leaves about a foot long. It has been found by Humboldt and Bonpland near San Francisco Solano on the Rio Cassiquiare in Brazilian Guiana, and by Martius near the Rio Negro branch of the Amazons. Its root is exported to Europe from the ports of Brazil. 3. *Smilax medica* of Schlechtendahl. It grows on the eastern slope of the Mexican Andes, and furnishes the root which is exported from Vera Cruz under the name of Sarzaparilla, It has an angular stem, with strong prickles at the knots, and only a few in the intervals; it produces leaves towards six inches long, chartaceous, acuminated, cordate, ovate, or hastate; and it bears umbels of flowers, which are succeeded by crimson berries somewhat larger than those of the mountain-ash. 4. A species, not yet fully described, but distinguished by a round,

spiny stem without axillary thorns, and by oblong distant leaves, was mentioned in 1829 by Dr Hancock as growing on elevated lands near the Rio Iniquem in Guiana, and producing the root most esteemed at Angostura under the name of Rio-Negro Sarza. *Smilax sarsaparilla* of Linnæus, to which the drug of European trade was long referred, is a native of the southern United States, is not known there to possess medicinal virtues (Lindley), and has probably never been commercial. 5. A species, not yet fully described, has been mentioned lately by Pöppig, under the name of *Smilax cordato-ovata*, as growing in Brazil, and supplying in that country a part of the root which is used in medicine. 6. The *Smilax papyracea* of Poiret, hitherto confounded with other species, has been also indicated by Martius as one of the sources of Brazil sarsaparilla. It has an angular stem, with axillary prickles, and elliptic acuminate leaves marked with three longitudinal lines. It grows on the borders of the river Amazon and its tributaries.—— Every species of sarsaparilla plant has a rhizoma which sends out numerous long horizontal roots or runners; and these roots constitute the sarsaparilla of the shops.

Several varieties of sarsaparilla are met with in European commerce. The most important of them are those called in the drug-trade Jamaica, Honduras, Brazil, Lisbon, Lima, and Vera-Cruz Sarsaparilla. These are easily distinguished when in bulk by the following characters, which are taken from specimens presented to me in 1834 as authentic samples of the kinds met with in English trade at that time. In the form of chips, as generally sold in retail shops, they are distinguished with difficulty.—JAMAICA SARSAPARILLA is in bundles towards twenty inches long; which are composed of folded roots, scarcely reaching the thickness of a goose-quill, and distinguished from all other kinds by their redder colour, the comparative thinness and inferior mealiness of the bark, and the much greater abundance of attached radicles,—whence druggists sometimes call this sort Red-bearded sarsaparilla.—The researches of Humboldt and Bonpland would make it appear, that this variety is the root of *Smilax officinalis*, and is produced on the Rio Magdalena in Columbia. But Dr Pereira's inquiries in London rather lead to the inference that its original commercial source is the Mosquito shore and Guatimala. It is the most esteemed of all in English pharmacy, and is preferred for preparing the officinal extracts.—HONDURAS SARSAPARILLA is in bundles nearly three feet long. The roots are rather thicker than in the last kind, and present fewer rootlets; their colour externally is not so red and more grayish; the epidermis is thinner; and the inner bark is on the other hand thicker, more brittle, in many places broken off the meditullium altogether, and so amylaceous that a fine white dust is easily driven out by rubbing it. It is commonly preferred in Britain for making the chips sold in retail shops,—but merely, I presume, because it looks more regular and smoother in that state

than the last sort. Its botanical source is not accurately known. It comes direct from Honduras Bay. Some sarsaparilla, however, said to be imported into England from that quarter, scarcely differs from the Jamaica variety.—BRAZIL SARSAPARILLA is in long cylindrical fibres, wrinkled longitudinally, fawn-brown, gray or blackish outside, mealy within, and resembles that from Honduras, but is still more free of rootlets, and very clean, in consequence of being made up into long cylindrical bales bound tightly round with spiral withes. It is produced most probably by the *Smilax syphilitica*, and perhaps also by *Sm. ovato-cordata*, and *Sm. papyracea*; and it is imported direct from Bahia and other Brazilian sea-ports.——LISBON SARSAPARILLA seems to be nothing else than the Brazil species imported by way of Portugal.——LIMA, often also called VALPARAISO SARSAPARILLA, is an inferior sort, commonly imported in large bundles, somewhat resembling the Honduras variety; but the roots are less amylaceous, and may be farther distinguished by being connected together by their rhizoma, called in trade Chump. It is imported from Lima in Peru, and Valparaiso in Chili; but its botanical source is not known.——VERA CRUZ SARSAPARILLA, for some years rare in the English market, is described as consisting of thin, tough, grayish-brown roots, connected by their rhizoma, presenting few rootlets, and destitute of starch or mealiness. (Pereira.) From its name it may be presumed to be the produce of *Smilax medica*, found by Schiede in the Vera Cruz province of Mexico.

Chemical History.—Sarsaparilla has scarcely any odour, but possesses a mucilaginous taste, with a feeble, slowly developed, bitterish acridity. The Jamaica species is the least mucilaginous and most acrid of those met with in European pharmacy; but its acridity after all is faint. Dr Hancock says, that the Rio-Negro sarsaparilla, in his opinion the only kind posessing any activity, has a peculiar nauseous acrimony which no other sarsaparilla possesses. Every species of this drug parts with its properties readily to water. Water is consequently its sole officinal menstruum, and is employed for preparing the infusion, decoctions, extracts, and syrup of the Pharmacopœias. If the active part of the drug be a volatile or easily destructible principle, as some suppose, the whole of these officinal preparations, with the exception of the Dublin infusion, are faulty. If on the contrary the active ingredient be not volatile, the processes of the Pharmacopœias seem well enough contrived for their object. The form of infusion has not been sufficiently attended to. That adopted by the Dublin College is peculiar, inasmuch as lime-water instead of common water is directed to be used for the solvent; but I do not know any circumstance in the chemical properties of the drug to require such substitution. An infusion, made by percolating the bruised root with cold water, would probably prove a good preparation. The *Decoctum sarzæ* is a simple officinal form, much in use at present. The *Decoctum sarzæ compositum*, con-

taining also the active parts of guaiac and sassafras, is a modification of the Lisbon diet-drink, long celebrated as an antisyphilitic. It is certainly however a faulty preparation so far as sassafras is concerned; for the active part of that drug is a volatile oil, which must be in a great measure driven off in concentrating the decoction. The *Extractum sarzæ* of the London and Dublin Colleges is best made with Jamaica sarsaparilla. This sort yields from 33 to 50 per cent of extract (Hennell); and Honduras root only from 20 to 26 per cent (Pereira). The cortical part of the root yields most. This preparation is generally and justly distrusted, owing to a suspicion that the prolonged heat, besides expelling volatile matters, may effect important changes in the fixed organic constituents of the root. The Dublin College therefore properly added, and that of Edinburgh, dropping the common extract altogether, has substituted, an *Extractum sarzæ fluidum*, in which the concentration is not carried so far. A preparation of this nature has been for some time made by most druggists, and is generally preferred by practitioners. It is made fit for keeping by the addition of a little rectified-spirit; and when seasoned with sugar, oil of sassafras, and hot aromatics, it makes a not unpalateable liqueur which probably possesses as much activity as any other officinal form. The *Syrupus sarzæ*, though retained by all the British Pharmacopœias, is an unnecessary addition to the list.—According to Dr Hancock, whose opinion on this subject is entitled to great weight, if the sarsaparilla be really of good quality,—which, however, he adds, is very seldom the case with what is to be got in Europe,—the only correct preparations of it are an infusion of the bruised root made by maintaining it for some hours at 212° without boiling, and one prepared slowly without heat at all. The formula used at Angostura is this: Pour two gallons of water over a pound of Rio-Negro sarsaparilla, two ounces each of rasped guaiac-wood, anise-seed, and bruised liquorice-root, one ounce of mezereon root-bark, a pound of molasses, and half a dozen cloves; shake the vessel thrice a-day, and proceed to use the infusion as soon as fermentation begins.

Discrepant accounts have been given of the composition of sarsaparilla. It contains much lignin, and some mucilage,—variable proportions of starch, which is most abundant in the Honduras and Brazil varieties, and least so in the Jamaica and Vera Cruz kinds,—a little resin, said by some to be acrid,—a trace of volatile oil, amounting to a 1600th of the root (Berzelius), and possessing, according to Dr Pereira, the peculiar acridity of the Jamaica kind,—and a crystalline principle, called Pariglin by its discoverer Pallota, and named by successive chemists Smilacin, Salseparin, and Parrallinic acid. Poggiale proved in 1834 that all these substances are identical. It is obtained by exhausting the bruised root with cold rectified-spirit in the way of percolation, distilling off most of the spirit, decolorizing the remaining tincture with an excess of acetate of lead, removing the excess of lead by a few drops

of sulphuric acid, allowing the filtered liquor to crystallize by cooling when sufficiently concentrated, and purifying the crystals by repeated crystallization. It is a neutral body, white, inodorous, of a bitterish, rather nauseous taste, sparingly soluble in water or cold rectified-spirit, but freely soluble in hot water. Its constitution is probably $C^{15}H^{13}O^{5}$ (Petersen). Iodine renders its watery solution orange.

Adulterations.—On the continent sarsaparilla is sometimes adulterated with the roots of the *Agave Americana*, *Asparagus officinalis*, and *Carex arenaria*, and with the twigs of the hop. In Britain these adulterations are unknown; and the chief fraud practised is the substitution of the inferior for the fine varieties of the true root. This imposition may be detected by the respective external characters of the several commercial varieties.

Actions and Uses.—There is scarcely any subject in the Materia Medica which has given rise to more discrepant opinions among practitioners than the therapeutic actions of sarsaparilla. Some maintain that it is in large doses emetic, and in moderate doses diaphoretic, diuretic, stomachic, tonic, and eminently alterative; and they use it accordingly to a great extent in most chronic constitutional diseases, such as inveterate syphilis, pseudo-syphilis, mercurio-syphilis, struma in all its forms, chronic rheumatism, and chronic eruptions. Others, admitting its emetic and nauseant properties in large, and its diuretic action in small, doses, nevertheless deny that it is of more use as an alterative in constitutional diseases than any other bland mucilaginous vegetable. The most pointed observations to the former effect are those of Dr Hancock, who says that the drug used in Guiana, when duly prepared, is emetic in large doses; that in less quantity it produces nausea, sweating, prostration and torpor; that when taken regularly for some time it acts as a restorative and aphrodisiac, causing constitutional sores to heal, and the body to become plump, the skin smooth, and the habits active; and that in Guiana it is a sovereign remedy for a species of strumous ulcers among negroes, chronic cutaneous eruptions, strumous enlargement of the joints in rheumatic habits, passive general dropsy, and a peculiar variety of neuralgia which is there apt to follow gonorrhœa. These statements however will not settle the question as regards European practice; for Dr Hancock at the same time insists that the sarsaparillas of European commerce are all of inferior quality; and that their preparations must be inert, because even the sarsaparilla used in Guiana loses all its properties if subjected to long boiling. British practitioners are almost equally divided in opinion. By a majority of physicians it is distrusted, if not rejected altogether. On the contrary Mr Lawrence has stated that it is held in great estimation among surgeons; and Dr Pereira argues in its favour from this circumstance, because their opportunities of experience are more extensive, by reason of the diseases in which it is chiefly employed,

coming more frequently under their cognizance than under that of the physician. But the fact is susceptible of a different explanation. To those surgeons who have abated the rigour and exclusiveness of the former mercurial practice in all syphilitic and syphiloid affections, the sarsaparilla which they substitute may well seem a sovereign remedy, without its actually being so. And besides, the fact used as an argument, though it may be applicable in London, does not apply elsewhere,—not in this city at all events; where some of the most eminent surgeons have abandoned sarsaparilla except as a *placebo*. My own opinion is, that the question is still not satisfactorily decided; that more careful observations are required, more especially in reference to the now acknowledged efficacy of simple non-mercurial treatment in secondary, pseudo, and mercurial syphilis; and that the probability is much in favour of the drug turning out very inferior in virtue to what its admirers imagine. The question is not unimportant. Admitting sarsaparilla does no harm, the subject deserves consideration in an economical point of view. In 1831, the quantity consumed in Britain amounted to 107,000 pounds (Pereira); and in 1821, the apothecary of one of the great London hospitals informed me he had paid at that time L.1500 for a single year's consumption of it.

Very little is known of the action of any of its proximate principles on the body. The pariglin of Pallota is said by him to cause nausea, vomiting, sweating, and depressed action of the pulse, when taken in the dose of thirteen grains.

The preparations of sarsaparilla are: *Pulvis sarzæ*, dr. i. ad dr. ii.—*Infusum sarsaparillæ compositum*, D. fl.unc. ii. ad fl.unc. iv.—*Decoctum sarzæ*, fl.unc. ii. ad fl.unc. iv.—*Decoctum sarzæ compositum*, fl.unc. ii. ad fl.unc. iv.—*Extractum sarzæ*, L. D. gr. x ad gr. xx.—*Extractum sarzæ fluidum*, E. D. fl.dr. iv. ad fl.unc. i.—*Syrupus sarzæ*, fl.unc. i. ad fl.unc. iii.

SASSAFRAS, *E. L.* LAURUS SASSAFRAS, *D.* *Root*, (*wood, and volatile oil*, D.) *of Laurus Sassafras*, L. (Lond. Dub.) —*of Sassafras officinale, Nees von Esenbeck and Ebermaier, Handbach* (Edin.) *Sassafras.*

OLEUM SASSAFRAS, E. L. D.

PROCESS, *Edin. Lond. Dub.* To be prepared from Sassafras according to the general directions for Volatile oils. See *Introduction.*

FOR. NAMES.—The term *Sassafras* or *Sassafraz* has been adopted in most modern European languages.

FIGURES of Sassafras officinale in Nees von E. 131.—Hayne, xii. 19—and as Laurus Sassafras in Steph. and Ch. iii. 126.

SASSAFRAS was first introduced to the notice of European physicians by Monardes in 1574.

Natural History.—The plant which produces it is a small tree

belonging to the Linnæan class and order *Enneandria Monogynia* and to the Natural family *Lauraceæ* or *Laurineæ*, and inhabiting Canada, Pennsylvania, Virginia, Carolina, Florida, and also probably Brazil. It is the *Laurus Sassafras* of Linnæus, the *Sassafras officinale* of Nees von Esenbeck, Hayne, and Lindley. The parts used in medicine are the root, wood, and flowers; but at present the bark and wood of the root constitute the only officinal parts employed in this country. The root is imported in branchy pieces, the crown of which sometimes measures eight inches in diameter, and the bark is often partially stripped off. The bark is of a grayish-brown colour on the surface, rusty-brown within, of an agreeable odour, like that of sweet fennel, and of a powerful, peculiar, warm, aromatic taste. The wood is dirty grayish-yellow, light and porous, and it possesses the same taste and odour as the bark, but more feebly.

Chemical History.—Its most important constituent is a volatile oil of which Neumann got about two per cent. The root-bark yielded to Reinsch only eight parts in 1000. This oil, the *Oleum sassafras* of the Pharmacopœias, is readily obtained by distilling the bruised bark or wood with water. A part of it sinks and the rest swims in water; but both appear in other respects identical, and may therefore be mixed together. It is colourless at first, but afterwards becomes pale yellowish; it has a powerful penetrating sassafras odour, and an acrid aromatic taste; and its density is greater than that of most volatile oils, being so high as 1094. It deposits crystals of stearoptin on standing exposed to the air. There is no simple preparation of sassafras in the British Pharmacopœias, except this oil. The root bark contains, besides some tannin, about 9 per cent of a substance allied to tannin, which has been called sassafrid (Reinsch). Both the wood and bark of the root yield their properties readily to hot water; and hence they are used as additions to various antisyphilitic or diaphoretic diet-drinks, more especially the *Decoctum sarzæ compositum*, *Decoctum guaiaci compositum*, and *Aqua calcis composita*, D. It must be remarked however, that, as the officinal decoctions are prepared by concentration with a boiling temperature, the most active part of the sassafras, its volatile oil, must be all dissipated.

Adulterations.—Sassafras is not subject to adulteration. Its quality may be judged of by the relative strength of the odour developed on sawing it. Its volatile oil is said to be adulterated on the continent with oil of lavender, oil of turpentine, or a mixture of oil of turpentine and oil of cloves; and Bonastre has given processes for detecting such impurities. But in Britain oil of sassafras is commonly pure.

Actions.—This drug is a warm aromatic stimulant, which acts as a diaphoretic, especially in conjunction with the other antisyphylitic vegetables, with which it is almost always united. The oil is

a good addition to the fluid extract of sarsaparilla. Given alone it is a hot carminative aromatic, like the oils of most plants in the Natural family to which the plant belongs.

The dose of its only simple preparation, the *Oleum sassafras*, is m. ii. ad m. x.

SCAMMONIUM, *E. L. D.* *Gummy-resinous exudation from incisions into the root of Convolvulus Scammonia, E. L. W. Spr.* *Scammony.*

TESTS, *Edin.* Fracture glistening, almost resinous if the specimen be old and dry: muriatic acid does not cause effervescence on its surface: the decoction of its powder, filtered and cooled, is not rendered blue by tincture of iodine. Sulphuric ether separates at least 80 per cent of resin dried at 280°.

CONFECTIO SCAMMONII, L. ELECTUARIUM SCAMMONII, D.

PROCESS, *Lond. Dub.* Take of
Scammony powder, an ounce and a half;
Cloves bruised, and
Ginger powder, of each six drachms;
Oil of caraway, half a fluidrachm;
Syrup of roses, a sufficiency.

Reduce the dry substance to a state of very fine powder and preserve them so. When the confection is required, triturate the powder with the syrup, and then with the oil, into a uniform mass.

EXTRACTUM *sive* RESINA SCAMMONII, E.

PROCESS, *Edin.* Take any convenient quantity of Scammony, in fine powder; boil it in successive portions of proof-spirit till the spirit ceases to dissolve any thing; filter; distil the liquid till little but water passes over. Then pour away the watery solution from the resin at the bottom; agitate the resin with successive portions of boiling water till it is well washed; and lastly dry it at a temperature not above 240°.

MISTURA SCAMMONII, E.

PROCESS, *Edin.* Take of
Resin of scammony, seven grains;
Unskimmed milk, three fluidounces.

Triturate the resin with a little of the milk, and gradually with the rest of it till a uniform emulsion be obtained.

PULVIS SCAMMONII COMPOSITUS, L. D.

PROCESS, *Lond. Dub.* Take
Scammony, and
Hard Jalap-extract, of each two ounces;
Ginger powder, half an ounce.

Reduce them separately to very fine powder; and mix them thoroughly together.

FOR. NAMES.—*Fren.* Scammonée.—*Ital.* Scamonea.—*Span.* and *Port.* Escamonea.—*Ger.* and *Swed.* Scammonium.—*Dut.* Scammoneum.—*Den.* Skammonium.—*Russ.* Skammonia smola.—*Arab.* Sukmoonia.—*Hind.* Mehmoodie.—*Beng.* Sukmoonai.

FIGURES of Convolvulus Scammonia in Nees Von E. 195.—Hayne, xii. 35.—Sibthorpe, Fl. Gr. 192.—Steph. and Ch. ii. 60.—Russel in Med. Obs. and Inq. i. 12.

SCAMMONY, one of the most esteemed of the active cathartics, has been known for at least twenty centuries,—the characters of the Σκαμμωνεα of Dioscorides agreeing closely with those of the modern drug.

Natural History.—It is obtained from the *Convolvulus Scammonia,* L. a beautiful climber, not unlike the common bindweed, or *Convolvulus sepium* of our hedges, but distinguished by pointed,

hastated leaves, and pale yellow flowers with purplish streaks. This plant was found by Sibthorpe in Rhodes; and it abounds in various part of the Levant. The Discoridean description does not at all correspond with the characters of the *C. Scammonia*, but closely with those of *C. farinosus*, which grows abundantly in Greece and the Grecian islands. The plant I have seen cultivated in some gardens of this country, as the scammony convolvulus is not the true species, but the *C. farinosus*, or one very like it.

Scammony, according to the most recent account transmitted by Dr Russel of Aleppo in 1752 to Dr Fothergill, is obtained by cutting the root across near its crown, and sticking shells into it to catch the juice that exudes. The root is very large, commonly three or four inches in diameter and as many feet long; but a single root yields only a few drachms of scammony. The juice flows out milky, and soon concretes under exposure to the air and evaporation. This identical process was followed in the days of Dioscorides; and the very same description of it is given by Zecchino Martinelli, a Venetian drug-merchant, who witnessed the preparation of the drug in Syria, and whose information, communicated to De Lobel, and published in that author's Adversaria in 1561, contained the first accurate account that was made public in modern times. At one period the inspissated juice was occasionally kept in the original shells, and underwent no farther preparation. Martinelli imported a large quantity in this shape. But such scammony very rarely leaves its original country now-a-days; and it is never to be found so made up in the English market. It is imported entirely from the Levant. At one time Aleppo furnished the finer qualities, and Smyrna an inferior sort; but none is brought now to this country except from Smyrna, and its distinction into Aleppo and Smyrna scammony, as designating respectively the better and worse kinds, is now obselete in English trade.

Scammony is so generally adulterated that it is not easy to fix the characters of the genuine drug. There is indeed no article of the Materia Medica which is adulterated so often, or which it is so difficult to find pure, even in mere specimens for scientific examination. I am indebted for various specimens of perfectly pure, or Virgin scammony as it is called, by druggists, to the kindness of several gentlemen of the wholesale trade in London, and also to Mr Duncan of this city. From these specimens the following description is taken.

Mons. Guibourt is the only pharmaceutic author in recent times who has had an opportunity of examining scammony in the original shells. The only specimen I have seen of pure scammony in bulk was in large irregular lumps, weighing towards three pounds; rough, worn, and ash-gray externally; but, where not frayed, dark greenish-black and of resinous lustre. Its fresh fracture was pale grayish-green, slowly passing to dark greenish-black, glimmering

in lustre, and altogether not unlike at first to some coarse kinds of bees-wax. This was an unusually fresh sample, which contained more than the average moisture. I have examined four other specimens which were older and more dry; and these agreed in presenting a compact, somewhat conchoidal fracture, a dark greenish black colour, and rather high resinous lustre. Virgin scammony is compact, light, very brittle, and easily pulverizable, exhales a strong peculiar odour, especially if breathed upon, possesses a faint analogous taste, and speedily forms a smooth emulsion when chewed, producing at the same time faint acridity in the back of the throat. Its powder is pale ash-gray. The characters of the scammony in shells are nearly the same; but it is paler.

Chemical History.—Pure or Virgin scammony is almost all soluble in boiling rectified-spirit; and sulphuric ether takes up at least 77 per cent, indeed 82 or 83 per cent, if the specimen be tolerably dry. It breaks down readily in water, forming a smooth, but not permanent emulsion. This variety of scammony is a true gum-resin, containing however but a small proportion of gum. The analysis of two distinct specimens of old scammony gave, in one hundred grains of each, 81.8 and 83.0 of resin, 6.0 and 8.0 gum, 1.0 and 0.0 starch, 3.5 and 3.2 fibre and sand, 7.7 and 7.2 water; and the moister specimen described above was composed of 77 parts of resin, 6 of gum, 5 of fibre and sand, and 12.6 of water, without any starch. The starch is an accidental ingredient, probably derived from the root. I have found it twice present, thrice wanting, and never in such quantity as to be indicated by iodine in a cold decoction of the crude drug,—because the other principles prevent the action of the test. The gum answers to the characters of the variety called arabin. The resin, which is the active principle, has a dirty greenish-brown colour and a feeble scammony odour and taste, if not quite pure; but when purified with animal charcoal, it becomes pale-white or wine-yellow and free equally of taste and smell. It is very soluble in ether, rectified-spirit, and even boiling proof-spirit; and its powder readily forms with unskimmed milk a fine, uniform emulsion, undistinguishable by colour, taste, or smell from milk of rich quality (Planche). This resin, the *Resina* or *Extractum Scammonii*, E., makes a convenient purgative when pure. It is best obtained, according to the directions of the Edinburgh Pharmacopœia, by boiling scammony powder in proof-spirit, distilling off the alcoholic part of the filtered solution, and purifying the resin, which separates in the residual water,—either by repeated agitation with boiling water and subsequent desiccation,—or more effectually by redissolving it in rectified-spirit, boiling the solution with animal charcoal, recovering most of the spirit by distillation, and driving off the remainder at a temperature about 260° or 280°. If rectified-spirit be used at the first, instead of proof-spirit, the process is

shortened; but the greater part of the gum remains in combination with the resin;—to which, for medicinal purposes, there can be no objection. Planche first pointed out that scammony-resin readily forms with unskimmed milk a fine uniform emulsion, undistinguishable in colour, taste, or smell from milk of rich quality. This preparation has been adopted by the Edinburgh College under the designation of *Mistura Scammonii.*

Adulterations.—The tests laid down by the Edinburgh College for pure scammony are intended to meet the prevailing adulterations. Spurious scammonies are still very common; but the pure drug is more frequent in trade now than when the last edition of this work was published. Three kinds of adulterated scammony are met with. The most common occurs in cakes between two and five pounds in weight, roundish, and plano-convex, as if they had been dried in shallow bowls and saucers. This is more ponderous than pure scammony, less brittle, and much less easy to reduce to powder, or form into an emulsion. Its colour outwardly is pale ash-gray, without any lustre. Its fresh fracture is earthy, compact on the whole, but slightly vesicular, like the outer surface in colour and permanently so under exposure, and nearly or entirely destitute of lustre;—in short it greatly resembles in appearance the common secondary gray limestones of this country. In odour and taste it coincides with pure scammony. Rectified-spirit and ether leave a bulky residuum. Muriatic acid causes effervescence with it. I have analyzed many specimens of this kind, and found them all to contain carbonate of lime, in a proportion varying from 15 to 38 per cent. I have an interesting set of specimens, acknowledged by the Levant merchant who furnished them to contain various proportions of chalk between these extremes, and to be authentic samples of the scammonies of the market. A great proportion of what is now met with in the shops is composed of the most impure of these scammonies, yielding not much more than 50 per cent of the active principle, or resin.——Another less frequent kind is sometimes in irregular, rugged lumps, sometimes in round flattish cakes. Occasionally it has a resinous fracture, like pure scammony, though darker; but more generally its fracture presents merely a waxy lustre and a permanent ash-gray colour. In the former case it is brittle; in the latter case it is broken or pulverized with difficulty. Like the chalky scammony, it yields much residuum when acted on by ether or rectified-spirit. A watery decoction of it gives an abundant blue precipitate with tincture of iodine. It is adulterated with starch and lignin, both of which are probably supplied by some coarse sort of flour, such as the flour of some of the pulses; and the proportion of impurity varies in different specimens between 13 and 42 per cent. This variety is not improbably the same, or nearly so, with that described by Dioscorides as the commoner sort of scammony in his time. His description agrees

with its characters; he mentions it as a spurious article; and he says the adulteration consisted of ὀροβινου ἀλευρον, the flour of a kind of vetch.——The third kind resembles sometimes the one, sometimes the other, of the two already mentioned; and it presents the impurities of both. The chalky scammony often contains three or four per cent of starch, which is a proportion sufficient to be indicated by iodine in its decoction. This amount may be accidentally present owing to carelessness in extracting the juice from the root. But the fecula conjoined with the chalk is also frequently too great to have proceeded from such a source. This kind furnishes the most impure specimens I have yet seen: In some I have found no more than 42 per cent of resin, or half the due proportion.——The following tabular view of the composition of various spurious samples may be appended.

	Calcareous.			Amylaceous.		Calc. Am.
Resin, - -	64.6	56.6	43.3	37.0	62.0	42.4
Gum, - -	6.8	5.0	8.2	9.0	7.2	7.8
Chalk, - -	17.6	25.0	31.6	— —	——	18.6
Fecula, - -	——	1.4	4.0	20.0	10.4	13.2
Lignin and sand, -	5.2	7.1	7.8	22.2	13.4	9.4
Water, - -	6.4	5.2	6.4	12.0	7.5	10.4
Total, -	100.6	100.3	101.3	100.2	100.5	101.8

It is probable that other adulterations are at times practised besides those mentioned above; but I have not met with them. Cow-dung is said to be sometimes used for the purpose. Guaiac, which has been lately stated to be used, will probably alter the external characters of pure scammony less than anything else; but it may easily be detected by a chemical test. The tincture of scammony has no effect on the fresh-cut surface of a raw potato; tincture of guaiac quickly renders it bright blue; and this effect is very perceptible when the latter tincture is mixed with the former in the proportion of five per cent only.——It may be added, that the term Scammony has been often applied generically to denote a variety of inspissated juices, which are analogous to the true drug in properties, approach to it in external characters, and are obtained from various species of Convolvulus, as well as from certain species of the Natural family *Apocynaceæ*. Thus, there is Montpellier scammony from the *Cynanchum monspeliacum*, Bourbon scammony from the *Periploca mauritiana*, German scammony from the *Convolvulus sepium*, and American scammony from the *Convolvulus Mechoacan*. All these varieties, which are of small value and properly considered as spurious, may be passed over here without notice, because they are quite unknown in the English market.

Actions and Uses.—Scammony is a powerful cathartic of the drastic kind; but does not appear to be in large doses, like most active cathartics, an energetic poison. Various opinions have been

entertained of its value as a medicine. It was a favourite purgative with Dioscorides and his successors; it was much in the hands of the Arabian physicians; and all early modern writers on the Materia Medica mention it as in constant use. At present it is in disrepute upon the continent; and some French and German writers vilify it, and talk of it as almost abandoned by practitioners on account of its irregular and often violent operation. In Britain on the other hand it has long been in great demand; and for some years the pure drug has cost wholesale 32 shillings a pound. Notwithstanding what foreign authors have said, its effects are far from being uncertain, if its quality be good and uniform, and provided it be given not alone, but, like the powerful cathartics generally, along with other substances of similar action. There is for example no purgative better fitted for general purposes than the compound colocynth mass, a great part of which is scammony. In using this drug attention must be paid to its degree of purity. The ordinary doses of scammony and of the compound colocynth mass imply that the scammony used is materially adulterated; and indeed no other is at present to be currently obtained. When the pure drug is employed, little more than half the amount of what is commonly prescribed ought to be given. Its best form is the compound colocynth pill or extract; its powder, though admitted into all the Pharmacopœias, is a clumsy method of administering it; nor can much more be said of the electuary of the London and Dublin Colleges. Where scammony is given alone, the best form for it is an emulsion, made with the aid of sugar or sweet almonds. But a superior preparation in this shape, and a very eligible cathartic in every respect, is the emulsion of the pure resin made with milk, as proposed by Planche, and adopted by the Edinburgh College. I have found between seven and fourteen grains of resin, in the form of this emulsion, to constitute a safe and effectual purgative. Half that quantity or less may be given to children; to whom it may be easily administered, because it is undistinguishable by any sensible property from milk itself. Another convenient form for giving the resin is that of biscuit, made by preparing a paste with a drachm of resin, five grains of Venice-soap, nine grains of sugar, an ounce of biscuit powder, and a few drops of water, and then dividing the mass into ten biscuits, which are to be dried spontaneously. One biscuit is an active purgative (Baader).

The officinal preparations of scammony and their doses are as follows: *Pulvis scammonii*, gr. x.—*Pulvis scammonii compositus*, gr. xxx.—*Pilulæ colocynthidis compositæ*, E. D. gr. x. *Extractum colocynthidis compositum*, L. D. gr. xv. *Electuarium* (D.) *Confectio* (L.) *scammonii*, gr. xl. *Extractum sive Resina scammonii*, E. gr. vii. ad gr. xiv.—*Mistura scammonii*, E. fl.unc. iii.

SCILLA, *E. L. D.* *Bulb of Squilla maritima, Steinheil in Ann. des Sc. Nat. 2ème Ser.* vi. (Edin.),—*of Scilla maritima, L. W. Spr.* (Lond. Dub.) *Squill.*

ACETUM SCILLAE, E. L. D.

PROCESS, *Edin.* Take of
Dried squill in small fragments, five ounces;
Distilled vinegar, two pints;
Proof-spirit, three fluidounces.
Macerate the squill in the vinegar for seven days in a covered vessel: strain, and express the liquor; add the spirit, and filter the whole.

PROCESS, *Lond. Dub.* Take of
Fresh dried squill sliced, fifteen (six, D.) ounces;
Distilled vinegar, six (three old wine, D.) pints;
Proof-spirit, half a pint, (four ounces by measure, D.)
Macerate the squill in the vinegar, in a covered glass vessel for seven days, shaking occasionally (for twenty-four hours with a gentle heat, L.) Squeeze, and add the spirit to the liquor when the impurities have subsided.

OXYMEL SCILLAE, L. D.

PROCESS, *Lond. Dub.* Take of
Honey, three pounds;
Squill-vinegar, a pint and a-half (two old wine pints, D.)
Boil them in a glass vessel with a gentle heat to the consistence of syrup.

PILULAE SCILLAE, E. PILULAE SCILLAE COMPOSITAE, L. D.

PROCESS, *Edin.* Take of
Squill in fine powder, five parts;
Ammoniac,
Ginger in fine powder, and
Spanish soap, of each four parts;
Conserve of red roses, two parts.
Mix the powders, add the other articles, beat them into a uniform mass, and divide it into five-grain pills.

PROCESS, *Lond. Dub.* Take of
Fresh-dried squill in powder, a drachm;
Powder of Ginger, 2 (3, D.) drachms;
Ammoniac, two drachms;
Spanish soap, three drachms;
(Syrup, a sufficiency, L.)
Mix the powders, beat them together with the soap (then with the ammoniac, D.), and lastly with the syrup (molasses, D.) to the proper consistence.

PULVIS SCILLAE, D.

PROCESS, *Dub.* Remove from the squill bulb its membranous integuments, cut it into transverse slices, dry it with a gentle heat, reduce it to powder, and keep this in glass bottles with glass stoppers.

SYRUPUS SCILLAE, E.

PROCESS, *Edin.* Take of
Squill vinegar, three pints;
Pure sugar in powder, seven pounds.
Dissolve the sugar in the vinegar of squills, with the aid of a gentle heat and agitation.

TINCTURA SCILLAE.

PROCESS, *Edin.* Take of
Squill in coarse powder, five ounces;
Proof-spirit, two pints.
Prepare this tincture by percolation as directed for tincture of cinchona, but without packing the pulp firmly in the percolator. It may likewise be prepared by digestion with the sliced bulb.

PROCESS, *Lond. Dub.* Take of
Fresh dried squill, five (four, D.) ounces;
Proof-spirit, two (old wine, D.) pints.
Macerate for 14 days and strain, *Lond.*
Macerate for 7 days, let the sediment settle, and pour off the liquor, *Dub.*

FOR. NAMES.—*Fren.* Scille.—*Ital.* Scilla.—*Span.* Cebolla Albarrana.—*Port.* Cebola Albarrã.—*Ger.* Meerzwiebel.—*Dut.* Seeajuin.—*Swed.* Sjölök.—*Dan.* Strandlög.—*Russ.* Skvilla; Morscov luk.

FIGURES of Squilla maritima as Scilla maritima in Nees von E. 55.—Hayne, xi. 21.—Steph. and Ch. iv. 153.

SQUILL is the Σκίλλα of Dioscorides, and was used by the Greek physicians for the same purposes to which it is still applied in modern physic.

Natural History.—The plant which produces it is a native of almost every part of the Mediterranean coast, and is also met with in Portugal and France. It belongs to the Linnæan class and order *Hexandria Monogynia*, and to the natural family *Liliaceæ*. It was till lately known by the name of *Scilla maritima*: but in 1836 Steinheil showed that it is distinguished from the genus Scilla by the structure of its seeds and nectaries; and he therefore proposed to remove it into a new genus under the name of *Squilla maritima*,—a change which has been generally adopted by botanists. The Edinburgh College, in adopting the new reference, has properly retained the old pharmaceutic name. The squill plant has a large imbricated bulb; and this produces annually a flowering stem from two to three feet tall, the upper part of which becomes covered in August and September with a cluster of numerous white flowers. The leaves succeed the flowers. The only officinal part is the bulb.

Squill-bulbs are imported from Malta and other Mediterranean ports, and also from St Petersburg and Copenhagen (Pereira); and they are commonly brought sliced down and dried. The bulb is pear-shaped, and consists of concentric scales, the outer ones of which are thin, membranous, and brownish-red, while those within are whitish, thick, fleshy, and full of juice. A variety with white outer scales is said by Dr Pereira to be preferred at present by English druggists. The average weight of the bulb is from half a pound to four pounds; but I have one which weighed ten pounds and a half when fresh. It is exceedingly vivacious. My large bulb, while lying on my museum-table, produced two stems, two feet tall, and covered with flower-buds, many of which became fully expanded; and a small one, after being kept in the same place for at least eight years without any signs of life, began also, without any change of circumstances, to push out its stem. When intended therefore for medical use, squill-bulbs ought not to be kept entire, but should be stripped of their outer coats, then cut transversely into slices, and dried carefully at a temperature about 100° F. This is the state in which squill is usually kept in the shops. The slices have when fresh a mucilaginous, disagreeably bitter and somewhat acrid taste, with a feeble odour like that of radishes. When dry they are somewhat translucent, without odour, and of a mucilaginous, strongly bitter, nauseous, but not acrid taste. When thoroughly dried, they are brittle and pulverisable; but they readily recover moisture, which renders them tough and somewhat flexible. Hence, in making the preparations of squill, the slices ought to be dried again before being weighed. For the same reason, not only must they be recently dried before being pulverized, but likewise the powder, the officinal *Pulvis scillæ*, must be preserved in very close vessels, otherwise it soon coheres and forms a firm mass.

Chemical History.—Squill yields its properties to water, spirit, and diluted acids; and its best solvents are proof-spirit and vinegar, which are therefore correctly adopted for various preparations in

the Pharmacopœias. The aqueous infusion is rendered deep-purple by the sesquioxide salts of iron, and is not affected by tincture of iodine or tincture of galls. Proof-spirit is used for the officinal *Tinctura scillæ*, which is most conveniently made by the method of percolation. The *Acetum scillae*, a familiar form, in use since the days of Dioscorides, might also be conveniently made in the same way. The Colleges still follow a different method, the details of which vary considerably, but with no important difference in the result. From this preparation are made the *Syrupus scillæ* of the Edinburgh Pharmacopœia and the *Oxymel scillæ* of the two other Colleges, by simple solution of sugar or honey in squill-vinegar, followed in the latter case by concentration. The honey of squills has no advantage over the syrup, and is more troublesome to prepare.——The composition of the squill bulb has been examined by Vogel, Tilloy, Buchner, and Landerer in succession, but with somewhat discrepant results. It contains when fresh about four-fifths of moisture, and seems to consist otherwise of lignin, phosphate of lime, uncrystallizable sugar, gum, a trace of tannin, and a poisonous bitter extractive substance, in which Landerer alone has discovered a crystalline principle, probably the true active ingredient of the drug. This substance, the Scillitina of chemists, is obtained by exhausting the bruised fresh bulb with diluted sulphuric acid, concentrating the solution, saturating it with lime, and, after three days' rest, exhausting the dried precipitate with rectified-spirit. On due evaporation and cooling, prismatic crystals are formed, which are bitter, not acrid, sparingly soluble in alcohol, insoluble in water or volatile oils, and capable of neutralising acids. Some have also indicated a volatile acrid principle in squill; but its existence is denied by others.

Adulterations.—Squill is not subject to adulteration, as met with in the English market.

Actions and Uses.—It possesses a great variety of actions; for it is irritant, emetic, cathartic, diuretic, and expectorant. It is in large doses a dangerous irritant poison, producing inflammation of the alimentary canal and urinary organs, and proving fatal to man in the quantity of twenty-four grains only of the powder. The fresh juice irritates the skin. In medicinal doses of moderate amount, its preparations produce vomiting, purging, or both; but they are uncertain in this respect, and are now seldom used as emetics or cathartics. Some constitutions are so susceptible of this irritant action of squill, that it cannot be safely used for any purpose, unless combined with opium. In less doses it excites nausea and depression of the pulse. It never stimulates the circulation, as was believed till after the close of last century. Its action as an expectorant may be exerted in connexion with its nauseating operation, but is also observed to occur independently from still smaller doses. This action is greatly increased by the addition of opium. Squill is one of the best of vegetable diuretics; and its effect as

such is increased by the conjunction of mercury, or digitalis, or some saline diuretic.

The special diseases in which it is employed are chiefly dropsy, catarrh, pneumonia, asthma and phthisis. Like other diuretics, it acts better in general, than in local dropsies, and in those which are asthenic than where inflammatory symptoms prevail. As an expectorant, it is most serviceable in chronic and subacute catarrh, whether idiopathic or occurring in connexion with pneumonia, emphysema, diseased heart, or phthisis. But there is not, as some even still imagine, any sound reason for avoiding it in acute affections of the chest on account of its supposed stimulant operation. An excellent form for giving it as an expectorant is a mixture composed of two fluidounces of syrup of squills, as much peppermint-water, half a fluidounce of ammoniated tincture of opium, as much compound spirit of lavender, and a fluidounce of syrup,—of which a tablespoonful may be taken three or four times a-day. I do not know any combination equal to this as a calmative expectorant in catarrh and phthisis. An excellent combination for diuretic purposes consists of one or two grains of squill, together with as much digitalis, made into a pill with conserve of red roses, and given thrice a-day; to which may be often advantageously annexed a mercurial pill every night, or from one to two drachms of bitartrate of potash thrice daily. When troublesome nausea, vomiting, or purging is caused by squill, the best corrective is opium.

Little or nothing is known of the properties of its supposed active principle, Scillitina, except that a grain of the impure extractiform substance will kill a dog with symptoms of irritant poisoning.

Its officinal forms and their doses are: *Pulvis scillæ*, gr. i. ad gr. iii. diuretic and expectorant; gr. x. ad gr. xv. as emetic.—*Acetum scillæ*, fl.dr. ss. ad fl.dr. i.—*Oxymel scillæ*, L. D. dr. i. ad dr. ii.—*Syrupus scillæ*, E. fl.dr. i. ad fl.dr. ii.—*Pilulæ scillæ*, gr. v. ad scr. i.—*Tinctura scillæ*, min. x. ad min. xxx.

SCOPARIUM, *E.* SCOPARIUS, *L.* SPARTIUM SCOPARIUM, *D.* *The (fresh, L.) tops of Cytisus scoparius, D. C.* (Edin. Lond.); *of Spartium scoparium, L. W.* (Dub.) *Broom-tops.*

Decoctum Scoparii, E.

Process, *Edin.* Take
Broom-tops, and
Juniper-tops, of each half an ounce;
Bitartrate of potash, three drachms;
Water, a pint and a-half;
Boil them together down to a pint and then strain.

Decoctum Scoparii Compositum. L.

Process, *Lond.* Take
Broom-tops,
Juniper-berries, and
Dandelion-root, of each half an ounce;
Distilled water, a pint and a half;
Boil down to a pint and strain.

EXTRACTUM SPARTII, D.

PROCESS, *Dub.* To be prepared from broom-tops in the same way as directed for Extract of Gentian.

INFUSUM SCOPARII, L.

PROCESS, *Lond.* Take of
Broom-tops, an ounce;
Boiling distilled water, a pint;
Digest for four hours in a covered vessel and strain.

FOR. NAMES.—*Fren.* Genêt à balai.—*Ger.* Pfriemen; Besenginster.—*Russ.* Drok.

FIGURES of Cytisus scoparius, as Spartium scoparium in Hayne, ix. 10.—Steph. and Ch. ii. 67.

The Σπαρτιον of Dioscorides and other Greek physicians is either our present officinal species, the common broom, or the allied species, Spanish broom.

The officinal species is a common indigenous shrub, abounding on exposed neglected banks. It belongs to the Linnæan class and order *Diadelphia Decandria,* and to the Natural family *Leguminosæ.* It is the *Cytisus scoparius* of Decandolle, the *Spartium scoparium* of others, and the *Sarothamnus scoparius* of some recent botanists. The only officinal part in the British Pharmacopœias is the green tops; but the whole plant possesses similar properties, and the seeds, which are more active, as well as more uniform in strength, have been preferred by many. The tops are directed to be used fresh for medicinal purposes. Their best preparation is either a simple decoction, or one of the compounded decoctions of the Pharmacopœias. The extract of the Dublin College is little in use. These preparations, as well as the tops themselves, and also the seeds, have a peculiar, bitter, nauseous taste, and the tops have a peculiar odour when bruised. Reinsch has found the tops to contain a concrete oil, a volatile oil, mucilage, albumen, gluten, and a neutral crystalline principle of intense bitterness.

Broom-tops and broom-seeds are emetic and cathartic in large, and diuretic in small, doses. Dioscorides used the seeds as an emetic. The tops were in great repute during the latter half of last century for increasing the flow of urine in dropsy; but though upheld by the warm commendations of Cullen, they had fallen into disuse, till they were again resumed for the same purpose a few years ago in various parts of this country, but chiefly in London. According to Dr Pereira, broom never fails to act on the kidneys, and is the most certain of all diuretics in dropsies. My own experience of it is far from being so favourable; yet I have sometimes seen it present energetic properties. Probably the seeds would constitute a better part of the plant than the officinal tops. Their dose is from ten to twenty grains.—As an indigenous plant of undoubted diuretic virtues, broom well deserves more careful examination.

Its officinal forms and doses are: *Decoctum scoparii,* E. fl.unc. ii. ad fl.unc. iv. ter indies.—*Decoctum scoparii compositum* and *Infusum scoparii,* L. idem.—*Extractum spartii scoparii,* D. scr. i. ad dr. i.

SCROPHULARIA NODOSA, *D.* *Leaves of Scrophularia nodosa, L. W. DC.* *Figwort.*

UNGUENTUM SCROPHULARIÆ, D.

PROCESS, *Dub.* Take of
Fresh leaves of Scrophularia, and of
Prepared lard, of each two pounds ;
Prepared suet, one pound ;
Boil the leaves in the fats till they are crisp, strain and squeeze the product.

FOR. NAMES.—*Fren.* Grande Scrophulaire.—*Ital.* Scrofularia.—*Span.* Escrofularia.—*Ger.* Braunwurzel.

FIGURES of Scrophularia nodosa in Eng. Bot. 1544.

FIGWORT is an indigenous herb, which grows in hedges and among brushwood. It belongs to the Linnæan class and order *Didynamia Angiospermia;* and the genus gives its name to the Natural family *Scrophulariaceæ.* The leaves, the only officinal part of the plant, have an unpleasant odour when bruised, and a bitter, somewhat acrid taste. Their properties are communicated with the aid of heat to oils and fats, and are therefore possessed by the Dublin *Unguentum Scrophulariae.* The plant has been analysed, but without any particular result.

Figwort is an emetic and cathartic, and in large doses probably irritant. Some hold it to be in small doses diuretic, and in large doses narcotic, like digitalis, which belongs to the same Natural family. Little positive information however is possessed of its actions. It is never used inwardly in this country; and its properties as an external remedy, though held to be useful by some in ringworm, impetiginous eruptions, and certain constitutional vesicular diseases of the skin, have not been found such as to bring it into general employment.

SENEGA, *E. L. D.* *Root of Polygala Senega, L. W. DC. Spr.* *Snake-root.*

DECOCTUM SENEGAE, L. D.

PROCESS, *Lond. Dub.* Take of
Senega, ten (three, D.) drachms ;
Water, (distilled, L.) two pints (a pint and a half, D.) ;
Boil down to a pint (eight ounces, D.), and strain.

INFUSUM SENEGAE, E.

PROCESS, *Edin.* Take of
Senega, ten drachms ;
Boiling water, one pint ;
Infuse for four hours in a covered vessel and strain.

FOR. NAMES.—*Fren.* Polygala de Virginie.—*Ger.* Senega-wurzel.—*Swed. Dan.* and *Russ.* Senega.

FIGURES of Polygala Senega in Nees von E. 412.—Hayne, xiii. 21.—Steph. and Ch. ii. 103.

SENEGA, called in its native country Seneka-snake-root, was introduced into medical practice about the middle of last century by Dr Tennant of Virginia, as an antidote in use among the Senegaro Indians for the poison of the rattlesnake; and he received a reward from the Pennsylvanian government for the supposed discovery.

Natural History.—It is produced by a little plant abounding in the United States and in Canada, the *Polygala Senega* of botanists. This plant belongs to the Linnæan class and order *Diadelphia Decandria*, and gives its generic name to the order *Polygalaceæ* in which it is arranged. It has a perennial root, which pushes up annually several stems, scarcely a foot tall. There are two varieties, one with lanceolate or ovate leaves and whitish flowers, the other with linear-lanceolate leaves and rose-coloured flowers. The officinal part, commonly called the root, is composed of a knotty root-stock and two principal true roots, between the thickness of a quill and that of the little finger, tapering, twisted, slightly branched, often surrounded by ringed protuberances, and carinated along their whole length. The root-proper consists of a yellowish-brown or grayish-brown, resinous-like bark, and a whiter, ligneous meditullium, the latter of which is inert. It has when fresh a strong peculiar odour, scarcely perceptible in the dried root; and its taste is sweetish, followed by heat and pungency, irritation in the throat, and a flow of saliva.

Chemical History.—It imparts its sensible qualities to water and spirit, and best to the former menstruum, which is therefore the officinal solvent. It has been analyzed with variable results by many chemists, especially by Feneulle, Dulong, Trommsdorf, and Quevenne; from whose researches it appears to contain gum, resin, oil, lignin, colouring matter, and a very acrid pulverulent principle, in all probability its active ingredient. This substance, variously called Senegin, Polygalin, and Polygalic acid, is viewed by some as an alkaloid, by others as an acid; and it contains no azote. It is obtained by washing an alcoholic extract with ether, dissolving what remains in water; adding an excess of diacetate of lead, suspending the precipitate in water, and transmitting sulphuretted-hydrogen to remove the lead; and then evaporating the solution, exhausting the extract with rectified-spirit, and expelling the spirit with a gentle heat. Quevenne says that this principle, at the temperature of ebullition, especially long-continued, forms an insoluble compound with the colouring matter and coagulated albumen of the root; and hence that the *Decoctum senegæ* of most Pharmacopœias is a faulty preparation, and the only correct one an infusion made with water about the temperature 100°. The Edinburgh College has therefore substituted the *Infusum senegæ* for the older preparation.

Actions and Uses.—Senega is in large doses an emetic and cathartic; and in small doses it stimulates most of the secretions, acting especially as a sialagogue, expectorant, diuretic, diaphoretic and emmenagogue. It has been chiefly commended as a local stimulant in relaxed sore-throat,—as an expectorant in chronic catarrh, and in protracted pneumonia where bleeding ceases to be admissible,—and as a diaphoretico-diuretic in rheumatism. It has been thought also useful in dropsy. It is of no use as an antidote to

snake-poison.—Six grains of its active principle will kill a dog in three hours, with symptoms of irritant poisoning.

Its officinal forms and doses are: *Pulvis senegae*, gr. x. ad dr. ss. —*Decoctum senegæ*, L. D. fl.unc. ii. ad fl.unc. iii. ter indies. *Infusum senegæ*, E. fl.unc. ii. ad fl.unc. iii.

SENNA, *L. D.* *Leaves of Cassia lanceolata and Cassia obovata, DC.* (Lond.) *Leaves of Cassia Senna, Linn.* (Dub.)

SENNA ALEXANDRINA, *E.* *Leaves of various species of Cassia, probably of Cassia lanceolata, Forskal's Fl. Ægyptiaco-Arab.—of Cassia acutifolia, Delile, Aegypte,—and of Cassia obovata, Colladon,—DC. Spr.—Alexandrian Senna. As imported, it also contains an abundant admixture of leaves of Cynanchum Argel, Delile, DC. Spr. which ought to be removed as far as possible by picking.*

SENNA INDICA, *E.* *Leaves of Cassia elongata, Lemaire-Lisancourt in Journ. de Pharm.* vii. *East-Indian Senna, var. Tinnivelly. Leaves for the most part large, unbroken, and free of brownness or blackening.*

CONFECTIO SENNAE, L. ELECTUARIUM SENNAE, E.

PROCESS, *Edin. Lond.* Take of
Senna, eight ounces;
Coriander, four ounces;
Liquorice-root bruised, three ounces;
Figs, a pound;
Pulp of prunes, (half, L.) a pound;
(Tamarinds and Cassia-pulp, of each, half a pound, L.);
White sugar, two pounds and a half;
Water, three pints.
Powder the senna and coriander; sift out ten ounces of the mixture. Boil (the residue with, E) the figs and liquorice in the water down to one-half; squeeze and strain the liquor, and evaporate it down to twenty-four fluidounces. Dissolve in this the sugar, and add the syrup to the prunes (and other pulps, L.) mix gradually the powder, and triturate the whole carefully into a uniform mass.

PROCESS, *Dub.* Take of
Senna-leaves in fine powder, 4 ounces;
Pulp of prunes, a pound;
Tamarind-pulp, two ounces;
Syrup of raw-sugar, a pint and a half, (old wine measure);
Caraway-oil, two drachms. Boil the pulps in the spirit to the consistence of honey, add the powder, and, when the mixture has cooled, the oil also. Mix the whole thoroughly.

INFUSUM SENNAE, E. INF. SEN. COMPOSITUM, L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Senna, an ounce and a half, (fifteen drachms, L.)
Ginger bruised, four scruples, (one drachm and a half, D.)
Boiling (distilled, L.) water, a pint, (and a half, old wine measure, D.)
Infuse for an hour in a covered vessel, and strain (through linen or calico, E.)

INFUSUM SENNAE COMPOSITUM, E. INF. SEN. CUM TAMARINDIS, D.

PROCESS, *Edin.* Take of
Senna, one drachm;
Tamarinds, one ounce;
Coriander bruised, one drachm;
Muscovado, half an ounce;
Boiling water, eight fluidounces.
Infuse for four hours, with occasional stirring, in a covered vessel, not glazed with lead, and then strain through linen or calico.
This infusion may be likewise made with twice or thrice the senna prescribed.

SYRUPUS SENNAE, E. L.

PROCESS, *Edin.* Take of
Senna, four ounces;
Boiling water, twenty four fluidounces;
Treacle, forty-eight ounces;
Infuse the senna in the water for twelve hours; strain and express strongly

through calico, so as to obtain a pint and two fluidounces at least of liquid. Concentrate the treacle in the vapour-bath, as far as possible, or till a little taken out on a rod becomes nearly concrete on cooling; and while the treacle is still hot, add the infusion, stirring carefully, and removing the vessel from the vapour-bath, as soon as the mixture is complete.

If Alexandrian senna be used for this preparation, it must be carefully freed of Cynanchum leaves.

PROCESS, *Lond.* Take of
Senna, two ounces and a half;
Fennel bruised, ten drachms;
Manna, three ounces;
Sugar, fifteen ounces;
Boiling water, a pint.

Infuse the senna and fennel at a gentle heat in the water for an hour; mix the manna and sugar with the strained liquid; and boil down to the proper consistence.

TINCTURA SENNAE COMPOSITA, E. L. D.

PROCESS, *Lond. Dub.* Take of
Senna leaves, three ounces and a half, (one pound, D.)
Caraway bruised, three drachms and a half, (an ounce and a half, D.)
Cardamom-seeds bruised, one drachm, (half an ounce;)
(Raisins, five ounces, L.);
Proof-spirit, two pints, (a gallon, D.)
Macerate for fourteen days, and strain.

PROCESS, *Edin.* Take of
Sugar, two ounces and a half;
Coriander bruised, one ounce;
Jalap in moderately fine powder, six drachms;
Caraway bruised, and
Cardamom-seeds bruised, of each five drachms;
Raisins bruised, and
Senna, of each four ounces;
Proof-spirit, two pints.

Digest for seven days, strain the liquor, express strongly the residuum, and filter the liquids. This tincture may be more conveniently and expeditiously made by percolation, as directed for compound tincture of cardamom.

If Alexandrian senna be used for this preparation, it must be freed of Cynanchum leaves by picking.

FOR. NAMES.—*Fren.* Séné.—*Ital.* Sena.—*Span.* Sen oriental.—*Port.* Senne de Alexandria; Senne de Palta.—*Ger.* Sennesblätter.—*Dut.* Zenebladen.—*Swed.* Sennetsblad.—*Dan.* Senne.—*Russ.* Aleksandrieskie list.—*Arab.* Suna.—*Tam.* Nilaverei.—*Hind.* Soona mukki.—*Beng.* Sona pat.

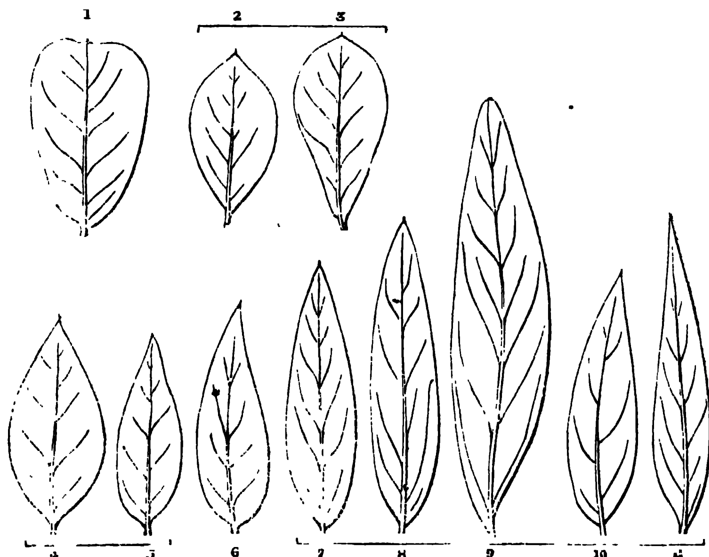
FIGURES of Cassia lanceolata in Nees von E. 345. Hayne, ix. 41.—Cassia acutifolia in Hayne, ix. 40. Nees von E. 346. Delile, Ægypte, t. 27, as Cassia Senna in Steph. and Ch. i. 30.—Cassia elongata in Journ. de Phar. vii. 548.—as Cassia lanceolata in Royle's Bot. Himal. t. 37.—Cassia obtusata in Hayne, ix. 43.—and as C. Senna in Nees von E. 348.—Cassia obovata in Hayne, ix. 42. Nees von E. 347.

IT is doubtful whether SENNA was known to the Greek physicians; but it was a familiar purgative among the Arabians. For many centuries it has been in extensive use throughout Europe, and equally in regular as in domestic practice.

Natural History.—There is still some confusion regarding the botanical source of senna. It is only indeed within a few years, in consequence of the researches of recent botanists, that the subject may be said to have been understood at all; and even still our information is singularly uncertain, considering that the drug has been so very long and so familiarly known. The reason is, that several species of plants which supply it were long confounded together, and that some of these approach one another so closely in external characters, that it is by no means easy even yet to define exactly their distinctions. It would be out of place to follow here the progress of medical botanists in their endeavours to fix the true species. It is sufficient to mention, that Linnæus in his species *Cassia Senna* plainly confounded several together; that Forskal was the first to fix with tolerable precision the characters of *C. lanceolata*, from

which Colladon afterwards clearly distinguished the *C. obovata;* that more lately several authors have agreed in detaching at least one other species from that of Forskal under the name of *C. acutifolia;* that several agree farther in detaching from these two species another with long slender leaves, the *Cassia elongata* of Lemaire-Lisancourt; and finally, that Hayne divided Colladon's species into two, *C. obovata* and *obtusata.* Much confusion has arisen in this inquiry from different authors using the same names for different species, and sometimes actually interchanging them. After attending with some care to the subject, and examining extensively the commercial sennas, the most satisfactory account of their botanical sources, though still in some measure imperfect, appears to me that of the late Professor Hayne of Berlin; whose authority has been followed in a great measure by the Edinburgh College. It will easily be seen from the sequel, that the references of the two other Colleges give no just idea of the drug as it is found in the market.

Hayne admits four species of Cassia, as constituting the sennas of European commerce, *Cassia lanceolata, acutifolia, obtusata,* and *obovata.* To these may also be added the *C. elongata,* although I am not satisfied that the distinctions between it and *C. acutifolia* are truly specific. The *C. lanceolata, acutifolia,* and *elongata* considerably resemble each other, while the two others are essentially different, though not easily distinguishable among themselves. The leaflets of all agree in being oblique at the base, but they differ otherwise in form, as will appear from the annexed outlines.



True Sennas. 1. Cassia obtusata, H. from Hayne's plate.—2. 3. Cassia obovata, H.

from Hayne's plate.—4. 5. Cassia lanceolata; 4. from Hayne's plate. 5. from Alexandrian senna.—6. Cassia acutifolia; shortest leaf in Hayne's plate.—7. 8. 9. 10. 11. Cassia elongata (acutifolia?); 7. 8. 9. from Tinnivelly senna, 7. the shortest, 9. the longest leaf; 10. from Royle's plate; 11. from a specimen raised at Saharunpore by Professor Royle.

The first three also differ materially from the last two in the structure of their pods; which are very thin and flattened in all, but in the first three are smooth and little curved, and in the last two much curved and lined on either side with a row of excrescences corresponding in number with the seeds. 1. The *Cassia lanceolata* of Hayne is the species first ascertained and described under that name by Forskal. In consequence of the confused use of this specific name by botanists, Dr Royle aptly proposes to designate it *C. Forskalii.* It abounds in various parts of Northern Africa, especially Upper Egypt and Nubia.—2. *Cassia acutifolia,* first accurately defined by Delile, may possibly be, as Forskal indicated, and as some still believe, a mere variety of the lanceolate senna produced by difference of climate. But on the whole it appears a distinct species. Its leaflet is larger, narrower and more pointed; it has a different texture, being thinner and more flexible; and there is little resemblance between the two species when the entire leaves are compared in bulk, not singly. Nees von Esenbeck says that the leaflets of the lanceolate species alone are hairy on their surface; but this is a doubtful character. This plant inhabits Arabia Felix and the neighbourhood of Syene.—3. *Cassia elongata* is a species which has been separated from the last by Lemaire-Lisancourt. Its leaflet is longer and comparatively narrower than even that of the last, and it is much thinner and more flexible than any other found in the commercial sennas. Still doubts may be entertained of its being a distinct species from *C. acutifolia.* Its native country is some part of the borders of the Red-Sea; but it is best known as naturalized both in Upper India, and at the southern extremity of the Indian peninsula. Dr Royle considers this and the former species to be identical with one another, and also with the "*C. lanceolata* of most authors;" and he proposes to include them all under that designation. But having withdrawn the name, as the source of confusion, from the plant to which it was first applied by Forskal, there would have been an advantage in abandoning it altogether, and retaining for the present species Delile's name of *C. acutifolia*, which can scarcely lead to mistakes.—4. Hayne's *Cassia obtusata*, a well characterized species, is the *C. obovata* of Colladon, and most botanists who have written on the subject since the publication of his paper on the genus Cassia. It grows naturally in many parts of Northern Africa, abundantly throughout the Indian peninsula, and also in Italy and Provence, where however it is probably not indigenous.—5. The *Cassia obovata* of Hayne differs from the species so named by previous botanists, as well as from his own obtusate senna, in presenting the termination of the leaf somewhat pointed; but this and the other characters

assigned to it by the Berlin Professor, though considered sufficient by so competent an authority as his countryman Nees von Esenbeck, seem scarcely adequate to establish it as as a well defined species. It grows in Arabia and in Egypt near Cairo.

These are the whole species of the genus Cassia which have hitherto been discovered in the sennas of European commerce. But various other species also possess purgative properties, and are on that account more or less used in the countries where they grow. Among these may be mentioned, *Cassia marilandica* of the United States, *C. corymbosa* of Brazil, *C. biflora* and *C. tomentosa* of Chili, *C. Absus* of the Levant, *C. alata* of Cuba, and *C. Porturegalis* of Jamaica. So far as we yet know, none of the species here enumerated is equal in energy to those which chiefly constitute the sennas used in Europe.

The commercial sources of senna are numerous. It is exported from Alexandria, Tripoli, Aleppo, Damascus, Moka, Bombay, and Madras. The chief sources of what is used in Britain are Alexandria, Tripoli, Madras, and Bombay,—the latter mart however being at present merely the entrepot for what comes originally from Moka and other ports of the Red-sea. As it differs greatly in quality and price according to its source, it is distinguished in the market by names taken chiefly from the places whence it is exported. The kinds best known in the English market are Alexandrian senna, Tripoli senna, and East-Indian senna.

Alexandrian Senna, often also termed Egyptian senna, is collected from Sennaar, Nubia and Upper Egypt, and made up at Boulak, not far from Cairo, under the superintendence of the Egyptian government. It is subsequently shipped at Alexandria for the European markets, to the amount of 15,000 hundredweight annually (Guibourt.) It is imported into this country in large bales and barrels. It is in general more highly esteemed throughout all Europe than any other variety; but the fine qualities of East-Indian senna have occasionally borne a higher price in Britain. It is an exceedingly composite article as imported. By much the greater part is composed of entire and broken leaves of *C. lanceolata*; but not a few leaflets of *C. obtusata* are likewise to be found in it at all times; and others may also be picked out of it which have the form of Hayne's *C. obovata*. It is believed that *C. acutifolia* was once common in this kind of senna, though it is rare now. I have once or twice found it in considerable abundance; and it may be added, that if Nees von Esenbeck is right in stating as its best distinction from the lanceolate senna, that the full-grown leaflets of the former have no hairs, while those of the latter are thickly beset with them, especially on the under surface,—which however is a doubtful criterion,—then, according to my observation, the *C. acutifolia* is far from being uncommon in Alexandrian senna. In this sort of senna, as imported, there are likewise to be found many pods of the lanceolate and obtusate species; and the latter are by much the

more numerous, though the corresponding leaflets are comparatively scanty. Cassia flowers moreover are common, and leaf-stalks and twigs abundant. There is besides a considerable number of pods, with a very few leaves, of a different leguminous species, the *Tephrosia apollinea.* The most important admixture however consists of the leaves, flowers, and fruit of one of the Asclepiadaceæ, the *Cynanchum* or *Solenostemma Argel.* For what purpose this plant is added appears doubtful. It can scarce be a fraudulent adulteration; for its leaves are not so like the true sennas as to pass for such with an experienced purchaser; and the notion of some, that it is put in to strengthen the senna, will be presently shown to be untenable. Nevertheless we are told by Rouillère, that it is added at Boulak in the proportion of a fifth of the whole; and, although both Hayne and Nees von Esenbeck say it is now a scanty ingredient in the Alexandrian senna of Germany, I have never found less than a twelfth part of the weight to be this plant, and once I picked out a sixth. From the lanceolate senna, to which it bears a distant resemblance, it may be easily distinguished by the characters mentioned below under the head of the adulterations of Senna.—— The quality of Alexandrian senna is esteemed according as the proportion of cynanchum leaves, senna-leaf-stalks, and pods, is small, according as the entire leaves of the lanceolate senna are abundant, and according to the strength and purity of its odour and taste. Its odour is peculiar and not disagreeable; and it has an unpleasant, mawkish, mucilaginous taste, with some sweetness, but with very little or no bitterness, notwithstanding what authors say to the contrary, provided the leaves of the cynanchum be avoided. In the shops of this country as well as in France, a superior article is to be met with under the name of Picked Alexandrian senna. This is prepared by the wholesale dealers in London by removing the pods, leaf-stalks, dust, stones, and other impurities. In Paris, most of the cynanchum leaves are also removed. But the London Picked-senna often contains much of it. It is the most important impurity however to remove.

TRIPOLI SENNA is inferior in reputation to the last. It differs little from it in general appearance, except that the leaves are more broken down, and the leaf-stalks more numerous. What I have seen of it contains neither the Cynanchum nor the Tephrosia, and but a small proportion of the obovate or obtusate senna, the chief ingredient being leaflets resembling the lanceolate species; but shorter, less pointed, and more regularly ovate than what are found in the Alexandrian variety. Nectoux holds these to be the leaflets of a distinct species, which he calls *Cassia ovata;* but farther inquiry is needed before this plant can be admitted to be anything else than a mere variety of *C. lanceolata*, depending on differences in soil and climate.——DAMASCUS and LEGHORN senna seem to differ from the present sort only in quality. The leaves present are the same; but they are more broken down, more mingled with leaf-stalks and dust, and of weaker aroma. Leghorn is merely the

entrepot of the latter of these two varieties, the drug being derived primarily from one or another of the African ports.

ALEPPO SENNA very seldom reaches Britain. It is represented to consist entirely of the *Cassia obovata* of Decandolle.

MOKA SENNA, so named from the port of that name on the eastern shore of the Red Sea, is now seldom met with in British commerce under its original designation. There is no reason to doubt, that it is identical with one of the varieties of the East Indian senna of the British market, called Bombay Senna. It seems to be the same with what has been lately described by Dr Theodor Martius, as imported into Germany by way of Trieste under the name of Mecca Senna, and stated to be the produce of the province of Hedjas in Arabia Petræa. A specimen of this sort in the collection of Martius, now in the possession of the College of Physicians of Edinburgh, seems to me identical with Bombay senna, but more broken.

EAST INDIAN SENNA is of three kinds, which it is essential to distinguish. These are variously called in the English market first, second, and third East Indian,—first, common, and coarse East Indian,—but more generally Tinnivelly, Madras, and Bombay senna.——BOMBAY SENNA was the first known of these. It has been ascertained to come in the first instance from the ports of the Red sea, especially from Moka; but it is almost always imported into England from Bombay. It consists entirely of leaflets and a few pods. The leaflets are much more generally entire than in any of the Mediterranean sennas, because they are thin, flexible, and not brittle. It contains but one species, the *C. elongata* of Lemaire-Lisancourt (possibly the *C. acutifolia* of Delile); and the leaflets never approach to the short, almost ovate form, often observed in the lanceolate senna. Its reputation is at present low, and not without reason; for many of the leaves are black or dark-brown from mismanagement, and its aroma, as well as its energy, is feeble. It is this kind that has been chiefly examined on the continent as East Indian senna; and consequently the East Indian sennas in general have but a sorry character abroad. I have been favoured by Professor Royle with a superior specimen,—exactly similar to Bombay senna, except that it is in good preservation,—which was raised by him a few years ago at Saharunpore, in Northern India, from seeds of Arabian senna obtained in the bazaars of Surat; and he informs me, that the cultivation of this sort is now generally followed in that quarter. An interesting fact, believed to have been ascertained relative to the Bombay senna, is, that its appearance under this name in the European market was coeval with the disappearance of a long, narrow species of leaf (*C. acutifolia*, Delile) once found abundantly in Alexandrian senna. This occurrence, if correct, is easily understood, considering the original sources of both varieties.——MADRAS SENNA is obtained from plants grown in the southern part of Hindostan, and imported from Madras. The plant was recently introduced into the British possessions

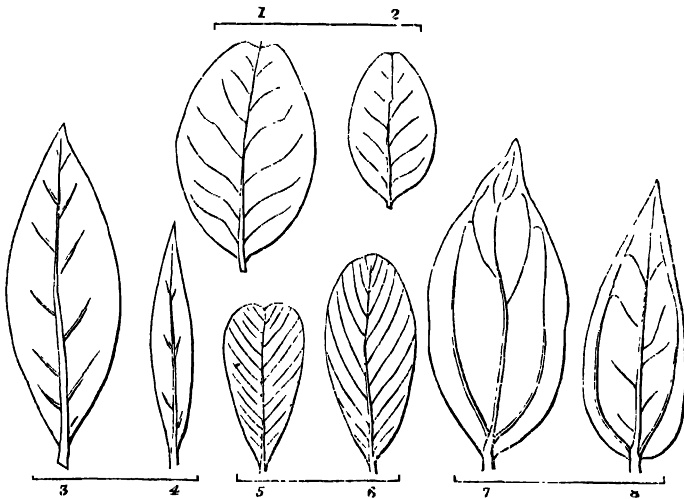
in the Indian Peninsula by means of seeds from the Red Sea; and it thrives luxuriantly in its new locality. The leaflets constituting this kind are larger than those of Bombay senna, and not so taper-pointed, but in other respects they do not differ, except in being on the whole better preserved. It is more esteemed than Bombay senna, being found more active.——TINNIVELLY SENNA is a superior variety of the last, also from Madras. It was first cultivated near Cape Comorin by a late spirited agriculturist, Mr Hughes (Ainslie); and the undertaking continues to be carried on by his representatives. The leaflets are still larger than those of Madras senna, and greatly larger, longer, thinner, and less brittle than those of *Cassia lanceolata* in the sennas from the Mediterranean. It is little known abroad, but is highly esteemed in this country, and is preferred to all other sorts in this and many other cities in Britain.

Chemical History.—The chemical properties and composition of senna, like its botanical sources, are open to further investigation. Its active part is easily dissolved out by water either cold or warm, by rectified-spirit, and by proof-spirit. Water and proof-spirit are the officinal menstrua for preparing the Infusions and Tinctures of senna. The Arabians of old were aware, that its watery infusions became less active when boiled; and although the circumstance seems to have been lost sight of or disbelieved by our colleges till the first English edition of the Edinburgh Pharmacopœia (1839), there can be no doubt of its truth. There is no comparison for example between the Syrup of senna prepared, on the one hand, by boiling down the whole materials together (Lond.), and on the other, by adding the infusion after concentrating the menstruum alone, as directed by the Edinburgh College. The syrup obtained in the latter way is incomparably the more active and certain of the two. The Alexandrian variety of senna has been analyzed by MM. Lassaigne and Feneulle; who obtained a great number of inert principles, such as mucilage, fixed oil, a trace of volatile oil, and others of less importance, together with a small quantity of uncrystallizable, deliquescent, extractive matter, which they considered the active principle and termed Cathartin. These results have been generally admitted; but their accuracy is questionable. The facility with which senna loses its virtues under the influence of heat augurs little for the soundness of a process, in which several evaporations by heat are practised; the form of the alleged cathartin, that of a deliquescent extract, is an equivocal one for a pure active principle; and I may add, that what I obtained on applying attentively the process of the discoverers to carefully picked Alexandrian senna had no effect whatever on a healthy adult. These results have been confirmed by similar researches of Heerlein. Was it not the bitter principle of the Cynanchum, always contained in commercial Alexandrian senna, that MM. Lassaigne and Feneulle obtained? The detection of the real purgative

principle of senna would in all probability prove a valuble practical discovery.

Adulterations.—Senna is exposed to a great variety of adulterations; most of which however are little known in British commerce, and are consequently unimportant to practitioners or druggists in this country.——The only important adulteration in British trade is with the leaves of the *Cynanchum Argel* or *C. oleæfolium*, the *Solenostemma Argel* of Hayne, which has been already mentioned as abounding in Alexandrian senna. It is met with only in this kind, and always in it as imported into Britain. The plant grows abundantly in Nubia and Upper Egypt. It is thought by some to be itself a powerful cathartic of the drastic kind, and to be mixed expressly on that account with the true senna leaves; to which others even add, that it is the cause of the superior activity supposed to have been remarked in Alexandrian senna over the other kinds. But these notions are ill founded. The cynanchum cannot increase the activity of the ordinary preparations of senna, for hot water takes up very little of its active ingredients; and authors seem mistaken in ascribing any particular purgative qualities to it, because repeated trials have convinced me that a syrup, containing the whole active part of a drachm of Cynanchum leaves extracted by means of rectified-spirit, which is its best solvent, operates very dubiously as a cathartic, though it occasions griping and severe protracted sickness. The same results have been lately obtained in Germany (Mayer). The leaves of the Cynanchum may be easily known from those of the true sennas. They present the shape of the lanceolate senna, but are much thicker and stiffer, more obscurely nerved, not oblique at the base, rugose and gray upon the surface, intensely and disagreeably bitter, and often spotted with a yellow, intensely bitter, gummy-resinous encrustation.——The leaflets of the *Tephrosia apollinea*, also found in Alexandrian senna, are very few in number. They are readily known by their downy surface, and by the transverse nerves proceeding parallel to one another from each side of the central nerve to the very edge of the leaf, without ramifying.——The most familiar extraneous substances in the senna brought to this country are senna pods and leaf-stalks,—a species of impurity which requires no commentary.——An adulteration practised abroad, but unknown in Britain, is with the leaflets of *Colutea arborescens*, or bladder-senna, a leguminous species often cultivated here in gardens and shrubberies. Its leaflets bear a close general resemblance to the obovate or blunt-pointed senna, but may be known by the want of obliquity at the base.——Another adulteration not uncommon on the continent, but never found in the sennas of the English market, is with the leaves of the *Coriaria myrtifolia*, a native of Southern Europe. This plant is a powerful astringent, and has been also thought to be a potent narcotic poison, which, taken instead of senna or along with it, may occasion unpleasant

symptoms, or even sometimes death itself. Yet Peschier, from frequent observation of its effects on man, as well as express experiments on animals, denies its alleged poisonous qualities. When present in senna, it is usually much broken down; but if a large enough portion of a leaf can be obtained, it is at once known by its two strongly-marked lateral nerves, which are not to be seen in the true sennas; and when this character cannot be applied, an equally good distinction may be found in the effect of sulphate of iron, which is precipitated dark-blue by the infusion of the coriaria, but not by an infusion of the true drug.——The preceding impurities are only found in the Mediterranean sennas. The East-Indian varieties do not contain any foreign ingredients; and the only important adulteration to which these are liable is with spoiled leaflets of a brownish or blackish colour, owing to imperfect preservation of the true plant. The Bombay senna is most subject to injury of this nature.——An outline is here annexed of the spurious sennas, which may be compared with that of the true species given at p. 844.



Spurious Sennas. 1. 2. Colutea arborescens, from the south of France.—3. 4. Cynanchum Argel, from Nees von Esenbeck's plate.— 5. 6. Tephrosia apollinea, from a plate in Annalen der Pharmacie, xviii. by Nees von Esenbeck.—7. 8. Coriaria myrtifolia ; 7. from Esenbeck's plate ; 8. from a dried specimen.

Actions and Uses.—Senna possesses but one action, that of a purgative; in which respect it is so certain, so manageable, and so convenient, that few remedies of its class are held in equal estimation. In point of energy it holds a middle place between the mild laxatives and drastic cathartics. It acts chiefly on the small intestines, increasing their mucous secretion as well as their peristaltic

motion, and producing loose brown evacuations. It does not depress the circulation or cool the system, like many other cathartics; but, if any thing, it has rather a general stimulating effect, which however is by no means so well-marked as to forbid its use in any circumstances of general excitement or reaction. Senna nevertheless is not without its objections; for it has a nauseous taste, and a tendency to cause sickness and severe griping. Various devices have been fallen upon for correcting these inconveniences; and in consequence a considerable variety of preparations have been introduced into the Pharmacopœias, which fulfil more or less completely the objects in view. The correctives resolve themselves into four,—spirit, aromatics, saccharine substances, and saline purgatives. The first is upon the whole ineligible, because often not effectual, and because the menstruum, to contain a sufficiency of the active part of the drug, must be given in too great quantity. Hence the tinctures of senna are seldom given alone. In the Pharmacopœias they also contain aromatics, constituting the *Tinctura sennæ composita*, E. L. D. The most effectual variety of this preparation is the Edinburgh tincture, which is strengthened by the addition of jalap. Hot aromatics, such as cinnamon, ginger, and the like, or the aromatic seeds and essential oils, such as coriander and caraway, are more efficacious and much in use. But perhaps the best correctives of all are saccharine substances. The effect of saccharine matter singly is well shown in the Edinburgh *Syrupus sennæ*, which has scarcely any taste of senna, is very effectual, and seldom causes either sickness or tormina. In the London *Syrupus* aromatics are also used; but the preparation is injured by protracted boiling after the addition of the senna to the other materials. A very superior syrup, prepared in Edinburgh by concentrating in vacuo a strong infusion drained by percolation, and then adding sugar and treacle, is now sold in great quantity under the name of Fluid Extract of Senna. It has no disagreeable odour or taste, scarcely ever occasions tormina, and is effectual in the dose of from two to four drachms. It appears to me by far the best of all the preparations of senna. Aromatics are sometimes added; but they are not necessary; and many dislike them. The conjunction of aromatics and saccharine substances is also practised with the various infusions of senna. The *Infusum sennæ*, E. or *Infusum sennæ compositum*, L. D. which contains both sugar and ginger, is a convenient and familiar form as an extempore preparation in the sick-room; but in Edinburgh it has been completely displaced by the syrup prepared in vacuo. The *Infusum sennæ compositum*, E., or *Infusum sennæ cum tamarindis*, D. is a more elaborate formula of the same description. Saccharine and aromatic substances are also combined in the *Electuarium* or *Confectio sennæ*, an old and favourite preparation, familiarly known by the name of the Lenitive Electuary, and acknowledged to be one of the mildest of the more effectual laxative compositions in the Pharmacopœias. Frequently however it is

spurious, and contains neither senna nor the pulps of fruits, but jalap for the purgative, and treacle for the saccharine matter. The addition of neutral laxative salts is another mode of preventing the tormina, apt to be caused by senna alone, and of increasing at the same time its activity. An excellent purgative mixture of this kind is composed of equal parts of the Edinburgh Infusion, and a solution of an ounce of Epsom salt in eight fluidounces of water; and the dose is a wine glassful every two hours till the effect commences. A common prescription of the same nature is a mixture of an ounce of the Edinburgh tincture of senna with an ounce and a half of sulphate of magnesia dissolved in four ounces of water and as much infusion of roses. A wine-glassful of this given every hour seldom fails to act with energy, and without sickness or tormina, and is an excellent combination for most febrile disorders. ——It has been thought by some that, in order to prevent the infusion of senna from exciting tormina, it is sufficient to make the infusion with cold instead of hot water. The old notion long entertained, that griping arose from the leafstalks mingled with the leaflets in many commercial sennas, is now, I presume, completely exploded. The activity of senna, like that of some other purgatives, is increased by combining it with the pure bitters.

It has been mentioned above, that of the numerous commercial sennas, the Alexandrian is the kind most generally preferred, as it is thought more active and more sure; but that the best qualities of East-Indian senna are displacing it in many parts of Britain. I understand there is still a decided preference for the Alexandrian in London; but in this city and most of the large towns in Scotland the Tinnivelly and even the Madras varieties are considered quite equal to it in every respect; and being cheaper as well as more pure, they are sold by our druggists in at least ten times the quantity of the other. So far as my own observation goes, this preference is amply borne out by facts; various practitioners have expressed their opinion to me to the same effect; and results of the same purport were obtained in some careful comparative experiments made lately in Germany (Kerner). From the concurrent testimony of various authors it appears, that the blunt-pointed senna is not above half the strength of the Alexandrian and East-Indian kinds.

The following are the officinal preparations of senna, with their doses: *Tinctura sennæ composita*, fl.unc. ss. ad fl.unc. ii.—*Electuarium sennæ*, E. D., *Confectio sennæ*, L. dr. ii. *Syrupus sennæ*, fl.dr. iv. ad fl.unc. i.—*Infusum sennæ*, E. *Infusum sennæ compositum*, L. D. fl.unc. ii. ad fl.unc. iv. *Infusum sennæ compositum*, E. —*Infusum sennæ cum tamarindis*, D. fl.unc. ii. ad fl.unc. iv.

SERPENTARIA, *E. L. D.* *Root of Aristolochia Serpentaria, L. W. Spr. Virginian Snakeroot.*

INFUSUM SERPENTARIAE, E. L.

PROCESS, *Edin. Lond.* Take of
Serpentaria, half an ounce;
Boiling (distilled, L.) water, a pint.
Infuse for four hours in a covered vessel, and strain.

TINCTURA SERPENTARIAE, E. L. D.

PROCESS, *Edin.* Take of
Serpentaria, in moderately fine powder, three ounces and a half;
Cochineal, bruised, a drachm;
Proof-spirit, two pints.
Proceed by percolation or digestion as for tincture of Cinchona.

PROCESS, *Lond. Dub.* Take of
Serpentaria 3 (and a-half, L.) ounces;
Proof-spirit, two (old wine, D.) pints.
Macerate for fourteen (seven, D.) days and strain.

FOR. NAMES.—*Fren.* Serpentaire de Virginie.—*Ital. Span.* and *Port.* Serpentaria Virginiana.—*Ger.* Virginianische schlangenwurzel.—*Swed.* Serpentaria.—*Dan.* Slangeurt.—*Russ.* Zmeevik virginskie.

FIGURES of Aristolochia serpentaria in Nees von E. 143.—Hayne, ix. 21.—Steph. and Ch. iv. 180.

VIRGINIAN SNAKE-ROOT has been known in Europe for more than two centuries, and was probably first brought under the notice of Europeans in America as an antidote for snake-poison.

Natural History.—The plant which produces it is the *Aristolochia Serpentaria*, a common inhabitant of woods throughout the middle and southern parts of the United States, but especially in Virginia, Carolina, and Louisiana. It is a perennial plant belonging to Linnæus' class and order *Gynandria Hexandria*, and to the Natural family *Aristolochiaceæ.* It consists of a bent zig-zag stem scarcely a foot in height, and of numberless root-fibres attached to a small roundish root-stock. It has cordate, pointed leaves, and produces close to the ground dirty purplish flowers, single, or two or three together, which are succeeded by hexangular capsules. Nees von Esenbeck has distinguished another species, under the name of *Aristolochia officinalis* (Plant. Med. Tab. 144), as furnishing in part what is brought to Europe under the name of Virginian snake-root; and says it is characterized by the root-radicles being much less numerous, the leaves more acuminate and scarcely cordate, and the flowers solitary. But in point of fact various species are apt to be mixed with the true root.

The drug of the European market consists of the root-stock, with a tuft of numerous radicles scarcely so thick as a fiddle-string, towards three inches long, interlaced, pale grayish-brown or yellowish-white, of a pungent, agreeable, camphoraceous odour, and of a warm, bitter, camphoraceous taste. Water, alcohol, and proof-spirit extract its sensible qualities; and the first and last of these menstrua are therefore used for making the *Tinctura* and *Infusum serpentariæ,* its only simple officinal preparations. The watery infusion is rendered blue by tincture of iodine, and brownish by the sesquioxide salts of iron; and it is not affected by tincture of galls. When distilled, the odour of the root passes over with the water. It contains an odoriferous volatile oil, and a bitter, acrid, extractive matter, with resin, starch, gum, albumen, and various salts (Chevallier). The prior analysis of Bucholz, and a later one by

Peschier, throw no additional light on its composition. Its properties seem to reside in the volatile oil and acrid extractive.

Adulterations.—It is often mixed with the roots of *Aristolochia hastata* and *A. tomentosa*, which are with difficulty distinguished from it, and with those of *Spigelia marilandica*, which are also not unlike it (Wood and Bache). Dr A. T. Thomson says it is sometimes mixed with the roots of *Collinsonia scabra* of Pursh; but this is denied by the authors last quoted.

Actions and Uses.—Virginian snake-root has been considered cathartic, stimulant, tonic, diaphoretic, diuretic, and emmenagogue. In large doses it excites nausea, griping, sometimes vomiting, and generally purging. It also excites the pulse, often causes fulness in the head, and generally increases the discharge from the skin (Jörg). In small doses it promotes the appetite. During last century it was a good deal used in typhoid fever, adynamic eruptive fevers, and malignant sore throat as a stimulant, in ague as a febrifuge, in dyspepsia as a tonic, and in amenorrhœa as an emmenagogue. It is now little employed in this country. It is of no service as an antidote for snake-poison. Though its virtues generally have been exaggerated by some, it deserves more attention than it has yet received as a tonic diaphoretic.—Besides the simple officinal forms, there are two compound preparations, of which it forms a part, the *Tinctura cinchonæ composita* of the three British Pharmacopœias, and the Edinburgh *Electuarium opii;* in neither of which however is it probably of material service.

The doses of its simple preparations are: *Pulvis serpentariæ*, gr. x. ad gr. xxx. *Infusum serpentariæ*, E. L. fl. unc. *Tinctura serpentariæ*, fl. dr. i. ad fl. dr. ii.

SEVUM, *E. L.* ADEPS OVILLUS, *D.* *Fat of Ovis Aries. Suet.*

ADEPS OVILLUS PREPARATUS, D.

PROCESS, *Dub.* To be prepared in the same way as Prepared Axunge.

FOR. NAMES.—*Fren.* Suif de mouton.—*Ital.* Sevo.—*Span.* Sebo.—*Port.* Sebo.—*Ger.* Hammelstalg.—*Swed.* Färtalg.—*Dan.* Faaretalg.—*Tam.* Aatoo kolupoo. *Beng.*—Buckrekeehirbie.

SUET was the Στεαρ προβατειον of the Greeks, and *Sevum* of the Latins; and was in use in medicine in the time of Dioscorides. That which is used now for medical purposes is obtained from the fat around the kidneys of the domestic sheep, by a process like that which has been described under the head of Axunge. It is similar in properties to axunge, but requires a temperature of 103° for melting it. It consists of stearin and olein with a little margarin (see *Axungia*). It is apt to become yellow and rancid when long kept; but when fresh and well prepared, it is white and almost without odour.

It is nutritive and emollient in action. It is not so easily digested as the fat of the pig and ox. It may be applied to most of the

purposes for which axunge is used, and is preferable on some occasions on account of its superior hardness and higher melting point; which properties it owes to the smaller proportion of olein and margarin in its composition.

SIMARUBA, *E. L. D.* *Root-bark of Simaruba amara, Aublet, Guian.* (Edin.); *of Simaruba officinalis, DC.* (Lond.); *of Quassia Simaruba, Linn.* (Dubl.) *Simaruba.*

INFUSUM SIMARUBAE, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Simaruba, bruised, three drachms (half a drachm, D.);
Boiling (distilled, L.) water, a pint (half an old wine pint, D.)
Infuse for two hours, and strain through linen or calico.

FOR. NAMES.—*Fren.* Ecorce de Simarouba.—*Ital. Span.* and *Port.* Simaruba.—*Ger.* Simaruba-rinde.—*Swed.* Simaruba.—*Dan.* Simarube.

FIGURES of Simaruba amara in Hayne, ix. 15.—Nees von E. 382.—As Quassia Simaruba in St. and Ch. iii. 171.—Wright, Edin. Roy. Soc. Trans. ii.

SIMARUBA was first brought to Europe in 1713 as an American remedy for dysentery; and the plant which produces it was first accurately traced, and described by Dr Wright as a species of *Quassia* in 1778.

Natural History.—There is still some difference of opinion as to the botanical source of the European drug. That which is brought to Britain comes from Jamaica, and is clearly derived from Dr Wright's plant, now known as the *Simaruba officinalis* of Decandolle, or *S. amara* of Nees von Esenbeck, Hayne, and Lindley. Lindley and others maintain that this plant is identical with *S. amara*, described in 1775 by Aublet, and the probable source of the root originally introduced into Europe from Guiana. But Hayne and Nees von Esenbeck consider this to be a different species. The Jamaica plant is a tall tree, belonging to the Linnæan class and order *Decandria Monogynia*, and to the Natural family *Simarubaceæ.* It is common in Jamaica, and is met with in other West-Indian islands. The leaves are pinnate, and the pairs from two to nine in number. The leaves are alternate, smooth, and shining, deep-green above and white below, and oblong-obovate according to the drawings of Wright, Hayne, and Nees von Esenbeck. It produces in April numerous diœcious small yellow flowers in scattered panicles, which are succeeded by black, shining, oval drupes, arranged four or five together on a common peduncle. The root is rough, scaly and warty, and its bark is intensely bitter; but the bark of the trunk is obscurely bitter and the wood without any bitterness. Aublet's description and drawing differ from this statement, inasmuch as the leaflets are oblong-ovate or almost lanceolate, the flowers are monœcious and appear in November and December, and the root-bark is not warty. The same author adds, that the bark and wood of the trunk exude a bitter milky juice when wounded, which Wright says is not the case with the Jamaica species.

The officinal part of the Jamaica plant is its root-bark alone, which is imported in folded slips, several feet in length. It is light, tough, yellowish-brown in its substance, grayish-yellow, rough and warty on its outer surface, without odour, and of a purely bitter not unpleasant taste. It cannot be easily pulverized by reason of its toughness. Its bitterness is readily extracted by water or spirit. It yields a similar extract to that derived from quassia-wood, and in greater abundance. It contains a bitter principle analogous to the Quassite of quassia, together with resin, a trace of volatile oil, and other unimportant ingredients (Morin).

Actions and Uses.—Simaruba is apt to excite vomiting and purging when taken in large doses. In other respects it seems to act on the whole very much like the other bitter tonics from the Natural family to which it belongs. It may be substituted for quassia in the various affections in which that drug is prevalently used. But it has also been prized as a calmative astringent in chronic dysentery and diarrhœa. This was the purpose for which it was first introduced into European medicine; and every now and then, while about to fall into disuse, it has been revived by the commendations of various physicians, such as Jussieu, Wright, and O'Brien.

The doses of its preparations are: *Pulvis simarubæ*, gr. x. ad gr. xxx.—*Infusum simarubæ*, fl.unc. i. ad fl.unc. ii.

SINAPI, *E.* SINAPIS, *L.* SEMINA SINAPIS, *D.* *Flour of the seeds of Sinapis nigra, L. W. DC. Spr., generally mixed with those of Sinapis alba, Ibid., and deprived of fixed oil by expression* (Edin.) *Seeds of Sinapis nigra* (Lond. Dub.) *Mustard.*

Tests, *Edin.* A decoction allowed to cool is not turned blue by tincture of iodine.

Cataplasma Sinapis, L. D.

Process, *Lond. Dub.* Take of
Mustard-flour, and
Linseed-meal, of each half a pound;
Warm vinegar, a sufficiency.
Make them into a poultice (which may be strengthened with two ounces of horse-radish, D.)

For. Names.—*Fren.* Moutarde.—*Ital.* Senapa; Mostarda.—*Span.* Mostaza.—*Port.* Mostarda.—*Ger.* Senf.—*Dut.* Mostaard.—*Swed.* Senap.—*Dan.* Sennep.—*Russ.* Gortshitza.—*Arab.* Khirdal.—*Pers.* Sirshuff.—*Tam.* Kadaghoo.—*Hind.* Rai.

Figures of Sinapis nigra in Hayne, viii. 40.—Nees von. E. 403.—St. and Ch. i. 42. Sinapis alba in Hayne, viii. 39.—Nees von E. 402.—St. and Ch. i. 42.

Black Mustard was the Ναπυ of Hippocrates and Σινηπι of Dioscorides.

Natural History.—The plant grows naturally in fields and banks in all parts of Europe, and is cultivated for domestic use. It belongs to the Linnæan class and order *Tetradynamia Siliquosa*, and to the Natural family *Brassicaceæ* of Lindley or *Cruciferæ* of other botanists. It is a herbaceous annual, about two feet high, with leaves lyrate below, but linear-lanceolate above, yellow flowers,

and small, obscurely quadrangular pods, which are terminated by a small style, and contain several dark-brown seeds. From *Sinapis arvensis*, Wild-mustard, Charlock, Kellock or Runch-seed, a more abundant indigenous plant, it is distinguished, at the period when the seed is gathered, by the latter species having an obscurely octangular pod terminated by a long sword-like beak. *Sinapis alba*, or White-mustard, an officinal species, has larger pods and yellow seeds. *Raphanus Raphanistrum*, sometimes confounded with the two officinal species, is easily known by its pods being jointed. The officinal part of the black and white mustard is the seed.

Black mustard seed is about the size of millet seed, roundish, brownish-black externally, yellow within, and greenish in powder, of an acrid, burning, bitterish oily taste, scentless when dry, but exhaling when moistened a penetrating diffusive vapour of a peculiar odour, and exceedingly irritating to the eyes and nostrils. White-mustard seed is nearly three times as large as the other, yellow externally as well as in its substance, and of a similar, but much more feeble odour and taste. Both are employed in medicine, the white mustard entire, and both together in the form of flour. The English and Irish Colleges admit only the black mustard as a constituent of the flour. But this, the true officinal mustard-flour, is not to be met with in the druggists' shops, who invariably substitute for it that which is prepared for the table. The Edinburgh College, sanctioning the practice, has endeavoured to define table-mustard, a task by no means easy. Dr Pereira says, on the authority of a mustard-manufacturer, that the best quality of mustard-flour is made with black and white mustard seed, twice sifted after being crushed and ground. I am informed however by one of the principal English manufacturers that his finest mustard is made in the following manner. Two bushels of black, and three of white seed yield when ground 145 pounds of flour; which, to diminish the pungency and improve the colour, is mixed with 56 pounds of wheat-flour, and two pounds of turmeric; and the acrimony is restored, without the pungency, by the addition of a pound of chilly pods and half a pound of ginger. Black seed alone, it is added, would be much too pungent for use at table. Wild mustard seed is sometimes substituted for the black species, if the latter be scarce. Some manufacturers remove the fixed oil from both the white and black seed by means of expression, before making them into mustard flour with the other ingredients; and the acrimony of the product is thus increased. Although common table-mustard serves for all the medicinal purposes to which the present drug is applied, yet I apprehend the Colleges ought to recognize only the stronger variety of it described by Dr Pereira as made with the *Sinapis nigra*, and *S. alba* only.

Chemical History.—The chemistry of mustard has engaged the attention of many eminent chemists; and the results are interest-

ing. But they are too complex to be produced here in detail, and in some respects they need confirmation. According to the most recent inquiries, those of MM. Robiquet and Boutron, of M. Fauré, of M. Bussy, and of MM. Boutron and Frémy, it appears, that black mustard consists chiefly of a bland fixed oil,—a peculiar bitter inodorous principle called by Bussy myroxic acid,—and another principle, termed by the same chemist myrosyne, analogous to vegetable albumen, and still more to the emulsin of bitter almonds. It farther appears that expression or sulphuric ether removes fixed oil only, and that alcohol then removes myroxic acid in an impure state; that if the analysis be begun with water for the solvent, an excessively pungent volatile oil is obtained, which may be separated in the usual way by distillation; and that this oil does not exist naturally in the seed, but is formed from the myroxic acid and myrosyne by the action of water, exactly in the same way as the volatile oil of bitter almond is formed from amygdalin and emulsin.—Myroxic acid is uncrystallizable, bitter and without odour. It consists of carbon, hydrogen, oxygen, azote and sulphur. The fixed oil of mustard amounts to about 28 per cent of the seed. It is thick like castor oil, pale-yellow, bland, and nearly free of odour.—The volatile oil is colourless at first, but afterwards yellowish or brownish, heavier than water, and of an intense penetrating pungent acridity. It boils about 290°. When treated with alkaline solutions, alkaline sulphocyanides are formed, as appears by the red colour struck with the sesquioxide salts of iron. The oil combines directly with an equivalent of ammonia and forms a white inodorous crystalline compound, possessing many of the characters of an organic base, called Thiosinammin (Will). The elements of the oil are the same with those of myroxic acid, and their proportions are 48.81 carbon, 4.98 hydrogen, 14.12 azote, and 32.09 sulphur (Löwig). These numbers correspond with the formula $C^8 H^5 N S^2$; and it may be viewed as a sulpho-cyanuret of allyle $C^6 H^5 + C^2 N S^2$ (Will). It is undoubtedly the principle, through the formation of which mustard possesses its peculiar properties as a physiological agent.

White-mustard has been less carefully examined. It contains more fixed oil than black mustard; it does not contain myroxic acid, and it cannot be made to yield any volatile oil. But alcohol extracts from it a crystalline principle analogous in composition and properties to myroxic acid, and called Sinapin or Sinapisin (Henry and Garot); a principle analogous to emulsin is also one of its constituents; and when these two substances are brought together in contact with water, a fixed, fatty, scentless, acrid compound is produced, and also some sulpho-cyanic acid (Bussy).

Adulterations.—Mustard-flour is much subject to adulteration. According to what was stated above, it is always impure; for there is none to be met with except what contains some intentional admixture. If it shall be held, that officinal mustard should consist

of nothing but the black and white seeds, the ordinary adulteration with wheat-flour is of course easily detected by iodine, as the Edinburgh College have pointed out; for neither species of mustard-seed contains any starch. The manufactured table-mustard is often adulterated with gypsum for exportation.

Actions and Uses.—Mustard is an irritant, stimulant, emetic, stomachic and diuretic. As an external irritant, it quickly excites redness of the skin, and, if too long applied, inflammation, ulceration, or even sloughing; but if removed in time, the redness is succeeded only by induration of the cuticle and occasionally desquamation. Hence it is in familiar use as a rubefacient in the form of what is called a sinapism. The London and Dublin Colleges have given a formula for preparing a sinapism, or *Cataplasma sinapis*. But it is incorrect; because the mustard is needlessly mixed with inert flour, and is used in too large quantity for economy, while the addition of vinegar, instead of increasing, rather diminishes its activity. A better method is simply to spread mustard as prepared for the table upon a common poultice, or merely on a piece of linen. Sinapisms are applied for removing pain, mitigating local inflammation, or rousing from stupor. They ought not to be left too long on the body when the patient is torpid, otherwise ulceration or sloughing may ensue. When the patient is sensible, his feelings will regulate the length of the application; and in the course of from fifteen to twenty-five minutes the pain generally becomes too intense to be borne any longer. The stinging pain, which remains after the removal of the mustard, may be mitigated, if too violent, by sponging the part with cold water or dropping ether on it. When cantharides blisters do not act, they may be often made to do so promptly by first applying a sinapism; but their action in that case is generally followed by superficial ulceration.

Mustard is used internally as a condiment, and is safe when taken in moderation. In larger doses it is sometimes used as a stimulant in narcotic poisoning. In still larger doses it is a good emetic. One, two, or three tea-spoonfuls of good table-mustard, taken with six or eight ounces of water, constitute a ready and effectual domestic emetic. At present however it is little in use as an internal remedy, either for this or any other purpose.

The volatile oil is a powerful rubefacient and vesicatory; and in the dose of two drops, taken several times a day in some mucilaginous vehicle, it has been lately found a good diuretic in dropsy. A liniment composed of one part of the oil dissolved in twenty parts of proof-spirit is a convenient substitute for a sinapism (Fauré).

White-mustard seed taken entire was some years ago a favourite tonic in this country for the treatment of dyspepsia, especially in asthmatic subjects. But its properties as an internal agent are not different, except in degree, from those of black-mustard. It is taken in the dose of a table-spoonful several times a day; but in this dose it must be swallowed entire, otherwise it becomes too pungent.

SODAE ACETAS, *L. D.* *Acetate of Soda.*

TESTS, *Lond.* Soluble entirely in water, not in alcohol. The solution does not affect litmus or turmeric; neither is it affected by chloride of barium, nitrate of silver, or chloride of platinum. Sulphuric acid evolves an acetous odour. Heat converts it into carbonate of soda.

PROCESS, *Dub.* Take any quantity of Carbonate of soda; add Acetic acid till it be neutralized; evaporate it to the density 1276; crystallize by cooling; dry the crystals and keep them in a close vessel.

FOR. NAMES.—*Fren.* Acetate de soude.—*Ital.* Acetato di soda.—*Ger.* Essigsaures natron.—*Russ.* Uksusnokisloe natr.

ACETATE OF SODA (Acetite of soda, Crystallized foliated earth of tartar) was first obtained by *Meyer* in 1767. In recent times it has become an important salt, because it is formed on a great scale in the course of the manufacture of pyroligneous acid. Hence the London College has adopted it as a commercial article of the Materia Medica, without a formula for preparing it. The Edinburgh Pharmacopœia does not contain it; for it is scarcely put to any use in medicine except for making acetic acid, which the Edinburgh College directs to be prepared from acetate of lead.

Chemical History.—This salt is prepared for the manufacture of pyroligneous acid by neutralizing the impure acid with lime, decomposing the acetate of lime with a strong solution of sulphate of soda, crystallizing the acetate of soda formed thus through double decomposition, and purifying the crystals by melting and again crystallizing them. From pure pyroligneous acid it may be obtained at once in the laboratory by neutralization with carbonate of soda, as directed by the Dublin College.

Acetate of soda is met with either in amorphous foliaceous masses of interlaced crystals, or crystallized in striated needles and oblique rhombic prisms variously modified. It is colourless, permanent in ordinary air, but somewhat efflorescent when the atmosphere is dry; and it possesses a cooling, saline, bitterish taste. It is soluble in three parts of temperate water and in less than its own weight at 212°. It is also somewhat soluble in rectified-spirit. Heat cautiously managed drives off its water of crystallization without expelling any acid; but as this requires a heat of 550°, and at 600° the acetic acid undergoes decomposition, the process requires great care for executing it completely. Sulphuric acid disengages acetic acid; which may be recognized even in a diluted solution by its peculiar odour. The salt is known to be a salt of soda, and not of potash, by chloride of platinum having no action on its solution. It consists of one equivalent of acid, one of soda, and six of water ($\bar{A}$ + NaO + 6 Aq.); and therefore of 51.48 parts of acetic acid, 31.3 parts of soda, and 54 of water; but it also occasionally crystallizes with nine equivalents of water (Anthon).

Adulterations.—It is not subject to adulteration. Nitrate of silver and chloride of barium will throw down a white precipitate and chloride of platinum a yellow one, if there be any sulphate, muriate, or any salt of potash present. The other tests of the Lon-

don College are intended for ascertaining what the salt is; but the statement, that it is insoluble in alcohol, is not exactly true.'

Actions and Uses.—Acetate of soda possesses the diuretic properties of the acetate of potash, but in a feebler degree. It has also been conceived to possess the property of repelling the milk. When swallowed it passes off by the urine. It is not now used in British medical practice. The London College adopts it in the formula for making Acetic acid; but the product is only a diluted acid (see *Acidum Aceticum*).

Its dose as a diuretic is scr. i. ad dr. ii.

SODAE AQUA EFFERVESCENS, *E.* SODAE LIQUOR EFFERVESCENS, *L.* SODAE CARBONATIS AQUA ACIDULA, *D.* *Solution of bicarbonate of soda surcharged with carbonic acid: Soda-water.*

TESTS, *Lond.* Litmus is reddened by it; but heat occasions effervescence and restores the purple colour.

PROCESS, *Edin. Lond. Dub.* Take of Bicarbonate of soda (Sesquicarbonate, L.) one drachm; Water, one pint (old wine, D.) Dissolve the salt in the water and saturate it with carbonic acid under strong pressure. Preserve the liquid in well-closed vessels. (The gas may be obtained from marble and muriatic acid diluted with six parts of water, D.)

Chemical History.—SODA-WATER was at one time prepared for medical use in an ingenious glass-vessel, called from its inventor Nooth's apparatus. It is now made by retailers with a powerful piece of mechanism, furnished with a forcing pump, by which the solution is much more highly charged with gas.

Soda-water is easily known by its violent effervescence when poured out, and by the characters for the bicarbonate of soda in solution. It is often made with an insufficient quantity of the salt, sometimes even without any salt at all. This may be of no consequence for ordinary domestic purposes; but it is of moment where the object in taking it is a medicinal one. Each of the ordinary soda-water bottles, which hold towards eight ounces, ought to contain a scruple at least of bicarbonate of soda.

Actions and Uses.—Soda-water is now a familiar article of drink in Britain, but is still little used on the Continent except medicinally. Like the corresponding preparation of potash it is antacid and antilithic; and it is one of the most effectual and agreeable of all liquids for allaying thirst in febrile diseases. As an antacid, it may be usefully given in dyspepsia, both at meals for preventing acidity, and afterwards for removing it. But as many dyspeptics suffer from distension caused by evolution of the excess of carbonic acid gas, the more common practice is to administer the carbonate or bicarbonate. It is a good form for the administration of an alkali in gravel; and it is the best antilithic in cases of phosphatic gravel, as will be explained more particularly under the article *Sodæ carbonas.* In continued fever and other febrile diseases it may be allowed freely as drink; and patients with fever generally relish it

much. It is well fitted for the same object in diabetes; and indeed there are few circumstances during disease which contraindicate its use. The notion of some that it causes determination towards the head in febrile diseases is without foundation. A strange prejudice, which has arisen lately in some quarters, has led to the substitution of potash-water for soda-water. In every essential property the two preparations are identical.

The dose is almost unlimited. A pint daily will be sufficient in general for use as an antilithic. When taken as drink in fever, a single bottle ought to be made to serve thrice; and in typhus it may be advantageously conjoined with wine.

SODAE BICARBONAS, *E. D.* *Bicarbonate of soda.*

TESTS, *Edin.* A solution in forty parts of water does not give an orange precipitate with solution of corrosive sublimate.

PROCESS, *Edin.* Fill with fragments of marble a glass jar, open at the bottom and tubulated at the top; close the bottom in such a way as to keep in the marble without preventing the free passage of a fluid; connect the tubulature closely by a bent tube and corks with an empty bottle, and this in like manner with another bottle filled with one part of carbonate of soda and two parts of dried carbonate of soda well triturated together; and let the tube be long enough to reach the bottom of the bottle. Before closing the last cork closely, immerse the jar to the top in diluted muriatic acid contained in any convenient vessel; when the whole apparatus is thus filled with carbonic acid gas, secure the last cork tightly; and let the action go on till next morning, or till gas is no longer absorbed by the salt. Remove the damp salt which is formed, and dry it, either in the air without heat, or at a temperature not above 120°.

PROCESS, *Dub.* Take of
Carbonate of soda, two parts;
Water, five parts;
Dissolve the salt in the water.
Expose the solution to a stream of carbonic acid from white marble dissolving in muriatic acid, until it cease to absorb gas. Let it rest till crystals form; evaporate at a temperature not above 120°, and then let it cool and crystallize. Mix and dry the whole crystals. Keep them in a close vessel.

TROCHISCI SODAE BICARBONATIS, E.

PROCESS, *Edin.* Take of
Bicarbonate of soda, one ounce;
Pure sugar, three ounces;
Gum arabic, half an ounce.
Pulverize them; and with mucilage beat them into a proper mass for making lozenges.

SODAE SESQUICARBONAS, *L.* *Sesquicarbonate of Soda.*

TESTS, *Lond.* Entirely soluble; and the solution is not affected by chloride of platinum, nor by sulphate of magnesia unless it be heated. A strong heat converts the salt into carbonate.

PROCESS, *Lond.* Take of
Carbonate of soda, seven pounds;
Water, one gallon.
Dissolve the carbonate in the water, filter, transmit carbonic acid to saturation, so that a salt may subside, which is to be pressed in folds of linen, and dried with a gentle heat.

FOR. NAMES.—*Fren.* Bicarbonate de soude.—*Ital.* Bicarbonato di soda.—*Ger.* Doppelt kohlensaures natron.—*Russ.* Dwuch uglekisloe natr.

THE substitution of the Sesquicarbonate for the BICARBONATE of SODA by the London College seems to be an error, probably originating in a mistaken idea of the nature of the salt usually found in the shops, which may possibly have been at one time a sesquicarbonate. But Mr Everitt and Dr Pereira both state that the commercial salt in London is chiefly bicarbonate, with a small proportion of carbonate or sesquicarbonate; and several careful

analyses I have made since 1837 of the salt sold by Edinburgh retailers, which all comes from England, justify the inference that it is intended for a bicarbonate, as it seldom contains above two or three per cent of carbonate. The new Edinburgh process gives very easily a perfect bicarbonate.

Chemical History.—BICARBONATE OF SODA (Carbonate of soda of the earlier editions of the Pharmacopœias) may be obtained, according to the Dublin formula, by passing carbonic acid through a concentrated solution of the carbonate; but this process is tedious, and attended with much waste of gas, unless pressure be employed. Some manufacturers economise carbonic acid, though not time, by exposing the solution for a long period in shallow vessels to the atmosphere of a fermenting vat. Sooner or later in either way bicarbonate of soda separates in minute grains, owing to its comparatively sparing solubility; and the mother-water yields more by cautious concentration at a heat not exceeding 120°. A degree of heat somewhat above this drives off part of the carbonic acid; and then a sesquicarbonate instead of a bicarbonate is separated. Another method once practised consists in gently heating carbonate of soda in a state of concentrated solution, along with three-eighths of its weight of sesquicarbonate of ammonia; which parts with its acid to the fixed alkali. From frequent trials, however, on the small scale, this method appears to me costly; because it is the first crystallization only which constitutes a true bicarbonate. On the great scale, manufacturers of late have generally abandoned all the liquid processes in favour of the dry way, which is superior in economy, convenience, and despatch. The process commonly understood to be followed is similar to that of the Parisian Codex of 1840; which consists in packing fragments of carbonate of soda upon a series of perforated shelves in a box, through the bottom of which carbonic acid is introduced in a stream regulated according to the rate of its absorption. The gas is very quickly absorbed; at the same time a liquid charged with carbonate or sesquicarbonate trickles down to the bottom of the box, owing to the carbonate containing more water of crystallization than is required to constitute the bicarbonate; this liquid is commonly withdrawn from time to time; and when absorption ceases, the salt is dried with a very gentle heat. A great improvement on this method in small operations, and one which will probably answer well upon any scale, is the process now adopted by the Edinburgh College. The crystallized and anhydrous carbonates are mixed in such proportions as to leave a slight excess of water over what is necessary for the water of crystallization of the whole salt when it all becomes bicarbonate; and carbonic acid gas is admitted to the bottom of the mixture by a tube proceeding from a pneumatic apparatus like a gasometer, so constructed that there never can be any waste of gas. The absorption of gas is completed within twenty-four hours; and the product is a perfect bicarbonate, not sesquicarbonate, of soda. The principal

details of this process were suggested by Mohr (Ann. der Pharm. xxix.); who proposes however to mix the anhydrous carbonate in larger proportion, so as to leave no excess of water over that required for the water of crystallization of the bicarbonate. On investigating the subject carefully, I have found that absorption does not take place at all with Mohr's proportions; that, with nothing but crystallized carbonate, the absorption is slow, and the disengaged water contains carbonate or sesquicarbonate; but that, with such proportions of the crystallized and anhydrous carbonates as will leave a slight excess of water, absorption is prompt, a slightly damp salt results, and there is not an appreciable quantity present of any other carbonate except the bicarbonate. The slight moisture disengaged in the process is easily removed by drying the salt, either spontaneously or at a temperature short of 120°.

Bicarbonate of soda is usually sold in powder, or in the form of small, white, opaque, irregular scales, of a saline, scarcely alkaline, not unpleasant taste, and permanent in the air. A moderate heat, by expelling one equivalent of its acid, as well as its water, reduces it to the state of anhydrous carbonate. It is soluble in thirteen parts of temperate water (Geiger), and in much less at 212°. From the latter solution it is obtained by slow cooling in minute hard white grains composed of radiated fibres. The solution has a feeble alkaline reaction on vegetable colours. It does not, like the carbonate, cause a white precipitate with sulphate of magnesia. With solution of corrosive sublimate it yields no precipitate, but merely a faint white haze; but under brisk agitation, or exposure for some time to the air, the haze gives place to a heavy, brownish-red, sometimes crystalline precipitate, attended with the disengagement of carbonic acid. When the solution is heated somewhat above 120°, carbonic acid begins to pass off; and at 212° (Berzelius) the salt becomes sesquicarbonate. The bicarbonate consists of one equivalent of base, two of acid, and one of water ($NaO+2CO^2+Aq.$),—that is 31.3 parts of soda, 44.24 of carbonic acid, and 9 of water.

Adulterations.—The only adulteration to which it is exposed in this country is with carbonate of soda, owing to faulty preparation. The ordinary commercial salt almost always contains a little of this impurity; and the source of it probably is, that the liquid, separated in charging the crystallized carbonate with carbonic acid, according to the common method of manufacturers, is not removed with sufficient care. A small proportion of carbonate imparts to the bicarbonate an alkaline taste and a decided alkaline reaction upon turmeric. But the proper test for it is corrosive sublimate, as pointed out by the Edinburgh College. This causes at once a reddish-brown precipitate in a solution in forty waters, if so much as a hundredth part of carbonate be present; but with the pure bicarbonate no such effect is produced unless with the aid of brisk agitation, or long standing, or heat.

Sesquicarbonate of Soda has been long known as a natural production under the name of Trona, and was one of the varieties of the Natron of the ancients. But its exact nature was first ascertained by Mr Phillips. It is obtained in large quantity under the soil in the Tripolitan district of Sukena in Africa, as well as around the borders of certain lakes in Egypt, Hungary, and South America. A solution of it may be obtained by heating solution of bicarbonate of soda to 212°; and some is also formed at a lower temperature. As shown above, it does not constitute any material part of the salt sold as bicarbonate in this country. And therefore it ought not to have been introduced into the London Pharmacopœia; much less ought it to have been substituted for the bicarbonate. The native salt is still known by the name of Trona. It contains from 2.5 to 7 per cent of impurities, chiefly sulphate of soda. It may be crystallized in minute rhombic prisms. It consists of two equivalents of base, three of acid, and four of water ($2NaO+3CO^2+4Aq$); and therefore contains 62.6 of soda, 66.36 of carbonic acid, and 36 of water of crystallization. It is less alkaline to the taste, and more soluble, than the carbonate. Its solution is not precipitated by sulphate of magnesia, but it yields a brownish-red precipitate with bichloride of mercury.

Actions and Uses.—Bicarbonate of soda is identical in its actions with bicarbonate of potash, except that it is a less active diuretic. It also, like that salt, closely resembles the carbonate of soda in action. It is not however, like the carbonate, a corrosive and powerful irritant. It is an excellent antacid and antilithic. Its uses as such will be better considered under the head of the carbonate, where the circumstances, which give a superiority to one compound of soda with carbonic acid over another, will be more conveniently stated. It is employed in great quantity for making effervescing powders (see *Sodæ carbonas*). Nearly equal parts of tartaric acid and bicarbonate should be used. The acid and alkaline salt ought not to be mixed as is sometimes done; for even when kept dry, the acid slowly decomposes the salt, and forms tartrate of soda. A drachm of Rochelle salt added to one of the ingredients renders the effervescing powders more purgative. This constitutes one of the varieties of what are called Seidlitz (Seignette's) powders.

SODAE BORAS, *D.* BORAX. *E. L.* *Biborate of soda.*

Tests, *Edin.* Not subject to adulteration. A hot concentrated solution, if treated with sulphuric acid, deposits copious scaly crystals on cooling.

Tests, *Lond.* Entirely soluble in water: its solution gives scaly crystals with sulphuric acid; and these dissolved in alcohol make it burn with a green flame.

Mel Boracis, E. L. D.

Process, *Edin. Lond. Dub.* Take of Honey, an ounce; Borax, a drachm; Mix them.

For. Names.—*Fren.* Borate de soude; Borax.—*Ital.* Borato di soda.—*Span.*

Borrax ; Atinkar.—*Port.* Tinkal.—*Ger.* Borsaures natron : Borax.—*Dut. Swed.* and *Dan.* Borax.—*Russ.* Bornokislie natr ; Bura.—*Arab.* Burak.—*Pers.* Tunkar.—*Tam.* Velligarum ; Vengarum.—*Hind.* and *Beng.* Sohaga.—*Sansc.* Tunkana.

Borax (Biborate, Borate, Sub-borate of Soda) was known to the ancients, but confounded with nitre and sesquicarbonate of soda under the name of Natron. Geiger and others suppose, however, that it was distinguished by Pliny, and is the *Chrysocolla* of that author. It is an abundant natural production in Persia and more especially in Thibet, being contained in the water of various lakes, on the margin of which it is left in impure crystals during the dry season. It is also met with in the mines of Potosi. In this state it is called Crude-Borax, or Tincal, which is probably a corruption of its Persian or Sanscrit name (Tunkar, Tunkana). Borax is farther obtained by uniting boracic acid with soda.

Chemical History.—The Tincal of commerce comes by way of Calcutta from Thibet and other parts of Asia. Three kinds of it are known in trade,—Indian tincal in small crystals, Bengal or Chandernagor tincal in large well-defined hexaedral prismatic crystals, and Chinese tincal, which is partially refined, and is imported in crusts and masses (Guibourt). That which is brought to Europe is opaque, of a waxy lustre, covered with a soapy substance or occasionally with argillaceous matter, and usually of a grayish, greenish, or yellowish colour. From this substance, which is an impure biborate of soda, all the borax of commerce was long prepared by the Dutch, according to a process which they contrived to keep secret. But in 1818 MM. Robiquet and Marchand made known the process now generally followed by manufacturers; which consists in rinsing tincal in lime-water, so as to decompose the alkaline soap on its surface and convert it into an insoluble calcareous soap,—dissolving the salt in water, and decomposing any remains of the alkaline soap in the solution by a little muriate of lime,—and finally evaporating and crystallizing by very slow cooling. This purified crystallized salt is sold by the name of Refined Borax.

Of late however a great part of the refined borax of commerce is prepared, not from tincal, but from boracic acid. This is an abundant natural production of certain lagoons and hot springs in Tuscany, as was first ascertained by MM. Hoefer and Mascagni in 1776, and likewise of the crater of Volcano, one of the Lipari isles. It was long before this important discovery was turned to any practical account. At length in 1827 a French merchant, M. Lardarel, having discovered boracic acid in the white vapours which are discharged from numberless rents of the soil in the Maremma, about seventy miles from Leghorn, built brick cylinders, two feet in diameter and several feet in height around the rents, and admitted water into them, which speedily began to boil, and soon became a solution of boracic acid, capable of yielding crystals

by concentration. He subsequently erected sixty of these cylinders at one spot, and afterwards extended his operations to nine other places in the neighbourhood; where the manufacture of boracic acid is now carried on to the enormous amount of 2,400,000 pounds annually, for the supply of most parts of Europe and America (Buchner's Repertorium, lxviii). The crude boracic acid thus got is an impure product. It contains in 100 parts, 76.5 crystallized boracic acid, 8.5 sulphate of ammonia, 2.6 sulphate of magnesia, 5.0 sulphate of lime, 1.2 silica, 1.3 sulphuric acid attached to the boracic acid, 6.6 of water, besides small quantities of the sulphates of soda, potash, and alumina, a little muriate of ammonia, and traces of manganese and organic matter (Wittstein). MM. Cartier and Payen have the merit of first introducing the manufacture of borax from this substance; which they succeeded in establishing in France in spite of various prejudices, compelling them in the first instance to send their borax to Holland and import it thence into France as Dutch borax. A great part of the borax now used on the Continent is prepared by decomposing carbonate of soda with the boracic acid of Tuscany, and purifying the biborate by various processes.

Pure borax is sold in crystals, which are large oblique rhombic prisms, or flattened prisms of six or eight sides, commonly terminated by two or four converging planes, translucent, shining, and possessing a peculiar sweetish-saline and somewhat alkaline taste. It effloresces slowly in the air. A moderate heat fuses it in its water of crystallization, which at a higher temperature is given off, leaving the salt anhydrous. At a still higher temperature it fuses again, and concretes on cooling into a transparent mass called Glass of borax, which becomes somewhat opaque under long exposure to the air. It is soluble in twelve parts of temperate, and two of boiling, water. A hot concentrated solution, decomposed by sulphuric acid, deposits a profusion of pearly colourless scaly crystals of boracic acid. When mingled with three times its weight of bitartrate of potash, the salt becomes exceedingly soluble, so that four parts of temperate water will maintain it in solution. A quadruple salt is probably formed, which is not crystallizable, but becomes by evaporation a gummy mass, known by the name of Soluble cream of water. A solution of borax is converted by mucilage into a firm tremulous jelly; and this is redissolved by syrup. Borax consists of two equivalents of acid, one of base, and ten of water ($2BO^3+NaO+10Aq.$); and therefore of 69.8 parts of boracic acid, 31.1 of soda, and 90 of water.

A different variety of borax occurs with only five equivalents of water of crystallization. This forms octaëdral crystals, harder than common borax, and not efflorescent. It is produced when a strong solution at 212° is cooled to between 132° and 174°.

Adulterations.—Borax is not subject to adulteration. The characters given by the Edinburgh and London Colleges relate only to the mode of distinguishing it. Geiger indicates sulphate and

muriate of soda, and also alum, as occasional adulterations. The last two may be detected by their taste; and the first by the effect of nitrate of baryta on a solution acidulated with nitric acid.

Actions and Uses.—Little is yet known of the medicinal actions of borax. It has been supposed by some to be a diuretic, antilithic, and emmenagogue. Its diuretic virtues have not been generally acknowledged. It has been strongly recommended in Germany as a corrective of lithic deposition from the urine, but has never come into use for that purpose in Britain. It is in extensive use, however, as an external application in affections of the mouth and in cutaneous diseases. A solution of a drachm in five ounces of water, with a little sugar or honey, forms one of the best applications for use as a gargle in the early stage of mercurial salivation, and likewise in all varieties of aphthous ulceration of the mouth and throat. In aphthous ulceration of the mouth in children it is an excellent remedy in the form of electuary made with honey. A wash made with borax has been often used in scaly cutaneous diseases. A solution of one drachm in two ounces of distilled vinegar was found by Dr Abercrombie an excellent lotion for ringworm of the scalp; and since being informed by him of this fact, I have repeatedly made use of it with the best effects in that often untractable disease. It has been likewise found serviceable in Pityriasis versicolor (Pereira).

Its doses and preparations are,—*Borax*, gr. xxx. ad gr. xl. *Mel boracis.* E. L. D., an external application for diseases of the mouth.

SODAE CARBONAS, *E. L. D.* *Carbonate of Soda crystallized.*

Tests, *Edin.* A solution of twenty-one grains in a fluidounce of distilled water, precipitated by nineteen grains of nitrate of baryta, remains precipitable by more of the test; and the precipitate is entirely soluble in nitric acid.—Little subject to adulteration.

Tests, *Lond.* Transparent when recently made; but efflorescent in an open vessel. Entirely soluble in water, but not in alcohol. It acts like alkalis on turmeric.

Process, *Lond.* Take of
Impure carbonate of soda, two pounds;
Distilled water, four pints.
Boil the impure carbonate in the water; strain the solution while hot; and set it aside to crystallize.

Process, *Dub.* Take of Barilla in powder, one part;
Water, two parts.
Boil the barilla in the water for two hours, with occasional stirring; and filter.
Triturate the residue with as much water and boil again. Repeat this procedure a third time. Evaporate the whole fluids to dryness in a wide iron vessel, avoiding so high a heat as might again liquefy the salt, and stirring it till it become white.
Dissolve the salt in boiling water, concentrate the solution to the density 1220, and expose it to a low temperature, about 32°, for crystallization.
Repeat the solution and crystallization if the salt be not pure. Keep the crystals in close vessels.

Sodae Carbonas Siccatum, E. Sodae Carb. Exsiccata, L.

Tests, *Lond.* Crystallized carbonate of soda, in drying with a strong heat, loses 62 per cent of water, but undergoes no other change.

Process, *Edin. Lond.* Heat any convenient quantity (a pound, L.) of carbonate of soda in a shallow vessel till it is dry, then urge it with a red heat in a crucible, and reduce it to powder when cold.

SODAE CARBONATIS AQUA, D.

PROCESS, *Dub.* Take any quantity of Carbonate of soda; dissolve it in a sufficient quantity of distilled water (one pound for every ounce of salt) to make a solution of the density 1024.

SODAE CARBONAS IMPURA, *L.* SODAE CARBONAS VENALE *sive* BARILLA, *D.* *Impure Carbonate of Soda: Barilla.*

FOR. NAMES.—*Fren.* Carbonate de soude; Cristaux de soude.—*Ital.* Carbonato di soda; sal di soda.—*Ger.* Einfach kohlensaures natron; Soda.—*Dan.* and *Swed.* Soda.—*Russ.* Uglekisloi natr; Soda.—*Arab.* Jumed chenee.—*Tam.* Kaium.—*Hind.* Kar; Sedgie muttie.—*Sansc.* Sarjica.

CARBONATE OF SODA (Carbonated Natron; Aerated mineral alkali; Soda; Subcarbonate of Soda) exists naturally in many mineral waters, of which Vichy in France, Vals in the same country, Bilin in Hungary, Carlsbad in Bohemia, and the Geyser fountains in Iceland, are remarkable examples. In these and most other springs however it coexists with a large excess of carbonic acid. It is also produced as a mineral, but in the form of sesquicarbonate, round the margin of some lakes in northern Africa, Hungary and South America. A more abundant source is the ashes of marine plants, and terrestrial vegetables growing on the sea-shore. But by much the greater part of what is now used in Britain is prepared by an elaborate chemical process from common sea-salt. Many varieties of crude carbonate of soda are in consequence to be met with in commerce. But, as an exceedingly pure kind has been for some time prepared in enormous quantities by the manufacturing chemist, and this is the only variety now sold in the shops of retailers, it seems unnecessary for the Colleges to admit any form except the pure salt into the Pharmacopœias. The Edinburgh College has alone acted hitherto upon this view of the case.

Chemical History.—Some years ago it was proposed to manufacture carbonate of soda in France from the alkaline springs of Vichy, St Nectaire, and the like; but I do not know whether the proposal has yet been realized.——It has been prepared immemorially from certain terrestrial plants growing near the sea-shore, more especially the *Salsola Soda.* This plant abounds naturally on the southern coasts of Spain, and is also cultivated there for the sake of its soda. When dried and burnt, a hard, cellular, bluish-gray, efflorescent mass is obtained, which is called Barilla, and which contains between fourteen and twenty per cent of carbonate of soda (Ure). Though barilla is still one of the officinal varieties of the carbonate, it is now scarcely ever seen in the shops, and its importation into Britain has fallen off greatly since the process of converting the muriate of soda into carbonate was perfected.——At one time a similar article was extensively prepared in Scotland from sea-weed. All kinds of sea-weed may be used; but the most productive are *Fucus vesiculosus*, *Fucus nodosus*, and *Laminaria digitata*, when at least three years old (Greville). The product of

their combustion is a hard, vesicular, dark-gray, bluish, or greenish mass, named Kelp; which contains between 5 and 8.5 per cent of carbonate of soda, together with a great variety of other salts, and among the rest a little iodide of sodium. The kelp manufacture at one time gave employment to 20,000 people in the Orkneys and Hebrides; but, like barilla, kelp has been driven out of the market by the article obtained through the decomposition of sea-salt. From kelp or barilla a pure carbonate of soda is easily obtained by the process of lixiviation and crystallization, as minutely detailed by the Dublin College. Several crystallizations are commonly requisite.

By much the most abundant source of the carbonate now used in medicine and the arts in this country is sea-salt. The first step in the process consists in the conversion of the muriate of soda into sulphate by means of sulphuric acid. The sulphate of soda thoroughly dried is then mingled intimately with chalk or limestone-powder, and powder of pit-coal, in the proportion of 100 of salt, 50 of coal, and from 110 to 120 of calcareous matter according to its purity; and the mixture is subjected to strong heat and frequently turned over, till flames cease to be emitted and a pasty mass is obtained. In this stage the product is called Black-ash, Black-balls, or Black-soda-ash; and when well prepared it contains soda, chiefly in the caustic state, and equivalent to about 55 per cent of dry carbonate. When black-ash is lixiviated and evaporated to perfect dryness, the soda is partially carbonated, and a white or gray compact substance is produced, which is termed White-soda-ash, or simply Soda-ash. In order to obtain carbonate of soda from this, it is roasted in a reverberatory furnace with its own weight of coal-dust or saw-dust at a temperature between 650° and 700° till blue flames cease to issue. During this stage and at the temperature specified, the soda becomes all carbonated and sulphur is burnt away. The mass being then lixiviated and concentrated till a pellicle forms on its surface, the solution is poured into tanks to crystallize (Ure). The manufacture of carbonate of soda from its muriate is now carried on throughout this country, but especially at Liverpool and Glasgow, on a prodigious scale of magnitude.

Carbonate of soda is now chiefly met with in the shops in the form of entire or broken crystals, which are commonly rhombic octaëdres, or oblique rhombic prisms, or forms derived from the latter. These are transparent, colourless, alkaline, caustic to the taste, though much inferior in that respect to carbonate of potash, and exceedingly efflorescent in the air. At a moderate heat they fuse in their water of crystallization; and a higher temperature drives off all the water, leaving a white, opaque, anhydrous carbonate, the *Carbonas sodae siccatum*, or *Carbonas sodae exsiccata* of the Pharmacopœias. A low red heat at least is necessary to expel the whole water; and a part is recovered under long exposure to the air. A full red heat fuses the anhydrous salt. The anhydrous

carbonate tastes much more alkaline and acrid than the crystals. The crystallized carbonate is soluble at 212° in its own water (which constitutes nearly two-thirds of the salt), and in two parts at 60°. It is insoluble in alcohol. The solution in water presents nearly the same characters with the solution of carbonate of potash, except that it does not yield a yellow precipitate with chloride of platinum or a crystalline one with tartaric or perchloric acid. The salts of lime, magnesia, and alumina yield with it white precipitates, and corrosive sublimate a reddish-brown one. It is distinguished in the solid state from carbonate of potash by its crystalline appearance and tendency to effloresce,—from bicarbonate of potash by its efflorescence,—from bicarbonate of soda by the latter being never distinctly crystalline. In solution it is distinguished from carbonate of potash by not yielding any precipitate with chloride of platinum, tartaric acid in excess, or perchloric acid,—and from bicarbonate of soda by producing a reddish-brown precipitate with corrosive sublimate and a white precipitate with sulphate of magnesia. It is, like other carbonates, decomposed by most acids, whether mineral or vegetable; and it converts the fixed oils and fats into soap. It is composed of one equivalent of base, one of carbonic acid, and ten of water ($NaO + CO^2 + 10$ Aq.); and therefore of 31.3 parts of soda, 22.12 carbonic acid, and 90 water.

A variety of crystallized carbonate of soda is met with, which contains only seven equivalents of water, and crystallizes in rectangular prisms. This is prepared by cooling a strong hot solution to 80°, but not lower; and it is sometimes formed in the soda tanks of the manufacturer in a hot summer.

Adulterations.—Some varieties of carbonate of soda are much exposed to adulteration, being seldom altogether free of sulphate of soda, and muriates of soda and potash. The carbonate of the shops in this country however, which is prepared from soda-ash, is for the most part remarkably pure. The testing formula of the London College will not indicate any of its adulterations; but is chiefly intended for distinguishing the salt from others. The Edinburgh formula allows of the presence of some muriate, but not of any sulphate. Nitrate of baryta is added to a given weight of carbonate of soda in solution, to throw down carbonate of baryta, and in such quantity as will leave 0.75 per cent of the salt still in solution, if it be of due purity; so that after filtration nitrate of baryta will again cause a precipitate. Hence if any salt stands this test, and the precipitate be entirely dissolved on the addition of nitric acid, so as to show that no sulphate is present, it cannot contain much above a 200th of impurity. Good carbonate of soda contains even less.

Actions and Uses.—Carbonate of soda resembles the fixed alkalis and the alkaline carbonates generally in its medicinal properties and uses. In large doses it is corrosive and irritant, but by no means so powerful in this respect as carbonate of potash. As a poison, it has no remote action except what arises directly from the

local injury inflicted. Its antidote is fixed oil, acetic acid, lemon-juice, bitartrate of potash, or any preparation containing an excess of acetic, citric, or tartaric acid.—In less doses it is a diuretic; but its activity as such is not equal to that of carbonate of potash. Like that salt, it passes off by the urine, which it renders alkaline.—It is an excellent antacid; but the bicarbonate is usually preferred to the carbonate of soda, as being less unpleasant to the taste; and by many soda-water is found superior to both.—As an antilithic it is in extensive use; but here too the bicarbonate is usually preferred. Some maintain that the carbonates of soda are less useful as antilithics than the corresponding salts of potash. This however is a mere prejudice; but larger doses of the soda salts are necessary. It has been thought that the alkaline carbonates generally are useful only in the lithic form of gravel. This too has been recently proved to be a mistake. The primary carbonates remove lithic gravel by correcting acidity in the stomach and rendering the urine alkaline; but in doing so, they may bring on phosphatic gravel through the alkalinity of the urine. If the bicarbonates however be given, the same effect is produced in correcting acidity of the stomach, and preventing the over-secretion, or at least the separation, of lithic acid; while the excess of carbonic acid also tends to maintain the earthy phosphates dissolved. The latter effect is more certainly secured if the alkali be taken in solution surcharged with carbonic acid, as in the form of an acidulous mineral water, like that of Vichy, or in the form of Soda-water and Potash-water. These valuable facts were ascertained not long ago by D'Arcet during a residence at the springs of Vichy. Twenty grains of bicarbonate in the morning and again after dinner maintain the urine permanently alkaline and free of lithic deposit; and probably two-thirds of that amount of bicarbonate of potash will have the same effect. Late trials by M. Petit tend to the conclusion that acidulous alkaline waters, such as that of Vichy, possess the property of breaking up calculus of the bladder by dissolving its animal matter. Some have thought they observed injurious consequences from the long-continued use of alkaline carbonates in gravel and acidity of the stomach; and diseases of the kidneys, as well as organic disorders of the stomach, have been referred to the practice. These suppositions are probably imaginary. There can be no question that many have used alkaline remedies habitually throughout a long life without injury.——Carbonate of soda is one of the principal salts used in the saline treatment of the typhoid forms of remittent, continued, and yellow-fever, as well as in malignant cholera. This practice, which was first proposed a few years ago by Dr Stevens, rests on the theory that the salts of the blood are defective in these diseases, and that their deficiency is the cause of the malignity of the symptoms, if not the cause even of the diseases themselves. And it consists in administering every hour, half-hour, or fifteen minutes, a solution of thirty grains of carbonate of soda, twenty of muriate of soda, and seven of chlorate of potash in four

fluidounces of water. The saline treatment of fever and cholera attracted much notice at the time it was made generally public; but the theory on which it rests is very far from being proved by its proposer; and though it was promulgated along with the encouraging fact, that 99 per cent of the fevers of the West Indies were cured by it in an extensive series of trials, it has never gained ground in this country, and it has proved useless in numerous cases where it was tried in the typhus of this city. Its application to the treatment of malignant cholera, where the blood is undoubtedly deficient both in salts and in water, was theoretically sounder than in the instance of fever; but its utility is questionable. In the trials made with it here it was useless, when the solution was given by the mouth; notwithstanding the wonderful temporary improvement produced at once by injecting it directly into the veins, doubts are entertained whether any cases were ultimately successful when the disease was decidedly formed; and at all events the proportion of favourable terminations was not greater than by other methods of cure. The alkaline carbonates have been thought useful in many chronic skin diseases, especially Lichen (Devergie).——Carbonate of soda has been much used for making effervescing powders, and Seidlitz (Seignette's) powders. But of late, since a cheap process was discovered for making the bicarbonate, this salt has been generally and properly preferred, as the effervescence is much more brisk. The acid generally used is the tartaric. The citric is equally good, but dearer; and lemon-juice also answers excellently. A table of the respective proportions of the several acids and alkaline carbonates to be used for effervescing powders is here annexed.

	Car. Sod.	*Bic. Sod.*	*Car. Pot.*	*Bic. Pot.*	*Sesq. Amm.*
Tartaric acid 30 grains,	57	34	28	40	24
Citric acid 30 grains,	64	38	32	44	23
Lemon-juice 1 fluidoz.	76	45	38	54	32

These proportions leave the solutions neutral or feebly alkaline after effervescence is over.

The dose of the carbonate of soda as an antacid or antilithic is gr. xx. ad gr. xl.—*Sodæ carbonatis aqua,* D. fl.dr. i. ad fl.dr. ii.

SODAE CHLORINATAE LIQUOR, *L.* *Solution of Chloride of Soda.*

TESTS, *Lond.* It first turns turmeric brown and then decolorizes it. It remains liquid when diluted hydrochloric acid is added; and both carbonic acid and chlorine are given off. The latter decolorizes sulphate of indigo; the former precipitates lime-water.

PROCESS, *Lond.* Take of
Carbonate of soda, one pound;
Distilled water, forty-eight fluidounces;
Chloride of sodium, four ounces;
Binoxide of manganese, three ounces;
Sulphuric acid, four ounces.
Dissolve the carbonate in two pints of the water. Put the chloride of sodium and oxide of manganese in powder, into a retort; and add the acid diluted with three fluidounces of water and allowed to cool. Apply heat to the retort, and pass the chlorine first through five fluidounces of water, and then into the solution of carbonate of soda.

FOR. NAMES.—*Fren.* Chlorure de soude.—*Ital.* Cloruro di soda.—*Ger.* Chlornatron · Natronhaltige bleichflüssigheit.—*Russ.* Chloristokisloi natr.

THIS preparation is the celebrated Disinfecting Liquor of Labarraque.

Chemical History.—Doubts are entertained as to its precise nature. As carbonic acid is not given off in the process for preparing it, the liquid has been held by some to contain bicarbonate of soda and chloride of soda in solution. But the more recent and generally received view supposes its composition to be even more complex, and that, by a change of elements, there are formed hypochlorite of soda, chloride of sodium, and bicarbonate of soda. In the process of the London College, supposing four equivalents of carbonate of soda present, the acid of two of them unites with the two others to constitute two equivalents of bicarbonate of soda; of the two equivalents of disengaged soda, one is decomposed, its sodium uniting with chlorine to form one equivalent of chloride of sodium, while its oxygen forms with more chlorine one equivalent of hypochlorous acid, which combines with the undecomposed equivalent of soda.

Labarraque's liquid may be obtained either by charging solution of carbonate of soda with chlorine according to the London process, or by decomposing chloride of lime with solution of carbonate of soda, according to the Parisian Codex. A dry preparation of analogous composition and properties may likewise be made, by transmitting chlorine, from eight parts of black oxide of manganese, ten of chloride of sodium, fourteen of sulphuric acid, and ten of water, into nineteen parts of anhydrous carbonate of soda moistened with one part of water. After the air of the apparatus has been expelled, all its junctions should be properly secured; upon which absorption of chlorine goes on slowly, with the disengagement of heat.

Chloride of soda (Hypochlorite of soda; Labarraque's disinfecting liquor; Fincham's disinfecting liquor; Oxymuriate of soda) is in solution colourless, with an odour of chlorine and an astringent taste. Turmeric is first turned brown by it, and then deprived of its colour. Sulphuric or muriatic acid disengages both chlorine and carbonic acid. Nitrate of silver throws down a white precipitate of chloride of silver; and lime-water causes a white precipitate of carbonate of lime. It may be distinguished from the similar compound of lime by not yielding any precipitate with oxalate of ammonia. By evaporation the liquid yields crystals; which are probably similar to the solution in nature, because they reproduce a fluid of the same properties when they are dissolved in water. According to the view given above of the nature of the disinfecting liquid, it contains for its solid ingredients two equivalents of bicarbonate of soda, one equivalent of chloride of sodium, and one equivalent of hypochlorite of soda ($2[NaO + 2CO^2] +$

NaCl + NaOClO); and consequently 151.08 of bicarbonate of soda, 58.72 chloride of sodium, and 74.72 hypochlorite of soda.

Actions and Uses.—The disinfecting liquid is an irritant poison of considerable energy, and it also seems to act remotely on the nervous system of the lower animals, since it causes depression and tetanus. These properties bear a relation to its chlorine or hypochlorous acid, rather than to its base, or to its constitution as a neutral salt. In small doses it has been held by some late inquirers to be a tonic, alterative, and febrifuge; and it has consequently been proposed as a remedy in strumous diseases, chronic affections of the liver, ague, and the typhoid forms of continued fever. In these respects it is probably on a par with chloride of lime, to which the reader is referred for farther information. Its utility as an external remedy is much better established, than its alleged therapeutic properties as an internal agent. When considerably diluted it is an excellent stimulant for ill-conditioned sores on the surface of the body, and especially for promoting cicatrization. Diluted with twenty-five parts of water, it is, in common with chloride of lime, one of the best of all washes for the mouth in the advanced stage of mercurial ptyalism, aphthæ of the mouth and fauces, or indolent ulceration and sloughing in these parts. It is useful, both as an astringent and corrector of fetor, in cases of fetid discharges from the vagina or nostrils. It is a good lotion for some cutaneous diseases attended with irritation of the skin; and is equal or superior to sulphur as a remedy for scabies. Lastly, it is an excellent antiseptic for destroying fetor of all kinds. It possesses no advantage however in any of these respects over the cheaper chloride of lime.

Its dose is *Sodæ chlorinatæ aqua*, min. xx. ad min. xxx.

SODAE MURIAS, *E. D.* SODII CHLORIDUM, *L.* *Salt: Impure commercial Chloride of Sodium.*

TESTS, *Edin.* None.

TESTS, *Lond.* Almost equally soluble in temperate and in boiling water: without action on litmus or turmeric: carbonate of soda and nitrate of baryta precipitate little or nothing.

SODAE MURIAS PURUM, *E.* *Chloride of Sodium.*

TESTS, *Edin.* A solution is not precipitated by solution of carbonate of ammonia followed by solution of phosphate of soda. A solution of nine grains in distilled water is not entirely precipitated by a solution of 26 grains of nitrate of silver.

PROCESS, *Edin.* Take any convenient quantity of muriate of soda; dissolve it in boiling water; filter the solution, and boil it down over the fire, skimming off the crystals which form; wash the crystals quickly with cold water and dry them.

FOR. NAMES.—*Fren.* Chlorure de sodium; Sel commun.—*Ital.* Cloruro di sodio; Sal comune.—*Spa.* Sal comun.—*Port.* Sal commum.—*Ger.* Chlornatrium; Kochsalz.—*Dut.* Zout.—*Swed.* Koksalt.—*Russ.* Chloristoi natric; Povarennaia sol.—*Arab.* Melk.—*Pers.* Nemuck.—*Tam.* Ooppoo.—*Hind.* Nimmuk.

CHLORIDE OF SODIUM (Muriate of soda, Salt, Sea-salt, Bay-salt,

Rock-salt, Common salt) is the most abundant of all saline substances. It is met with in nature in the solid form in vast quantity, constituting strata of great magnitude, as exemplified in the salt-mines of Cheshire and of Wielickza in Poland. It exists more or less in every kind of terrestrial water; and in some springs it abounds so much as to be profitably extracted from them, as at Salzhausen in Silesia, Kissingen in Bavaria, Salina in the State of New York, and Droitwich, Middlewich and other places in Cheshire and the adjacent counties of England. Farther, it constitutes the principal saline ingredient of sea-water. Lastly, it exists in most animal and vegetable fluids.

Chemical History.—Various kinds of salt, more or less prized in commerce, are obtained from many of these sources. That which is dug from the earth is sold in the crude state under the name of Rock-salt or Stone-salt. It forms compact masses of various sizes, tending to the cuboidal form, translucent, colourless or reddish, bluish, yellowish, or gray, and somewhat deliquescent in moist air. For domestic use it is purified by solution and crystallization.—From mineral springs salt is obtained either by concentrating their water with the aid of heat or by spontaneous evaporation. At Salina in the United States a great quantity of excellent salt is prepared by spontaneous evaporation of spring-water in shallow tanks, which are covered up in moist weather, but exposed during drought or wind. First sulphate of lime crystallizes upon the sides of the vessels; and the residual liquor, transferred into other similar tanks, furnishes subsequently fine cubical crystals of muriate of soda. At Kissingen in Bavaria a different plan is pursued. The water is conducted in pipes to the top of hurdles of great extent, composed chiefly of blackthorn branches, and exposed on both sides freely to the air, but covered above. As the water trickles over the hurdles it evaporates with rapidity, and sulphate of lime crystallizes beautifully and abundantly on the twigs. The remaining liquor, which is a concentrated solution chiefly of chloride of sodium, is then evaporated by boiling it in the ordinary way. Much of the salt used in Germany is prepared by analogous modes from the numerous saline springs of that country.—From sea-water, which contains two and a quarter per cent of chloride of sodium, salt is made either by spontaneous evaporation or by boiling it down in proper vessels. In the former way is obtained, chiefly in the warmer countries of Europe, the Bay-salt of commerce, which is known by its constituting large grains approaching the cuboidal form. In the latter way,—by concentrating sea-water with the aid of heat,—the greater part of the salt used in this part of the country has been for some time prepared. Sulphate of lime is deposited in the early part of the evaporation; and after the chloride of sodium has crystallized, a mother-water is left which contains a large proportion of magnesian salts. This variety of salt, commonly called Sea-salt, is found in the shops in small, white, irregular grains,

tending to the cubic form. Sea-salt and Rock-salt are often subjected to purification by dissolving and again crystallizing them. One variety thus obtained forms large sugar-loaf masses of loosely-aggregated small grains, and is called Basket-salt from being often sold in conical baskets. Another constitutes crystals of moderate size, of a cubic form, or assuming the appearance of hollow four-sided pyramids, the inside of which often presents a step-like arrangement of the particles. This is usually confounded, under the name of Bay-salt, with what is obtained from sea-water by spontaneous evaporation.

The best qualities of commercial salt are bay-salt and basket-salt. They are known by their form already described, and by their having less tendency than others to deliquesce in moist air. In common however with all other commercial kinds, they contain an admixture of foreign salts, which are chiefly alkaline and earthy sulphates and muriates, but especially sulphate and muriate of magnesia. These are most abundant in rock-salt, next in sea-salt, and least in bay-salt and basket-salt. There are few therapeutic or pharmaceutic purposes for which even the most impure of them is unfit. But sometimes a purer salt than any is required; and therefore the Edinburgh College has introduced a process for purifying it by solution, evaporation, crystallization, and washing of the crystals. In this way, and at no great loss, a salt is procured which stands all the tests given by the Pharmacopœias of London and Edinburgh. The washing of the crystals must be performed by running a stream of cold water through them for a few seconds only, otherwise much loss will be sustained by the solvent action of the water.

Chloride of sodium in the pure state presents the form of crystalline grains of a cubical form; and by slow evaporation it may be crystallized in regular cubes, which are transparent and colourless. It is permanent in ordinary air, but becomes moist on the surface in a damp atmosphere. Its taste is purely saline. Heat causes it to decrepitate owing to a little water being enclosed amidst the particles of its crystals. A red heat fuses, and a white heat volatilizes it. It is soluble in two parts and two-thirds of temperate water. Its solubility is very little increased at 212°, indeed not at all, as some think, if the salt be quite pure (Fuchs in Geiger). I have constantly found however that a concentrated boiling solution of good sea-salt yields a few crystals on cooling. When it dissolves in water, it may be considered either to do so as chloride of sodium, or to become, according to the older doctrine, hydrochlorate of soda by decomposition of water. The solution yields with nitrate of silver a curdy white precipitate, which is redissolved by ammonia, reappears on the ammonia being neutralized by nitric acid, and remains permanent when that acid is added in excess. It is distinguished from solution of chloride of potassium by not yielding, like that salt, a yellow precipitate with chloride of platinum, or a crystalline depo-

site with tartaric acid. Chloride of sodium is sparingly soluble in rectified spirit, but scarcely at all in absolute alcohol. It communicates to the flame of spirit a bright yellow hue. It is decomposed by sulphuric and nitric acids, muriatic acid being disengaged. It is composed of one equivalent of each of its elements (Na+Cl), consequently of 23.3 parts of sodium and 35.42 of chlorine.

Adulterations.—It is subject to adulteration in this country with sulphates, nitrates, and muriates of lime and magnesia. The formula of the London College will detect any sulphate, as well as the earthy bases. Carbonate of soda will indicate lime and magnesia together; and nitrate of baryta will detect sulphuric acid in any state of combination,—each of them occasioning a white precipitate. But the formula will not discover nitrates, which are sometimes present in appreciable proportion, and render the salt unfit for making pure muriatic acid. In the Edinburgh formula carbonate of ammonia will indicate lime with sufficient delicacy; and after this phosphate of soda will discover magnesia. Salts of other acids besides muriatic acid will be pointed out in a general way by nitrate of silver applied, as the College directs, in such proportion to the chloride of sodium, that, were the chloride pure, a slight excess of it will be left in solution and be indicated by a fresh addition of the silver test. On the continent salt is sometimes adulterated with arsenious acid, and sometimes with an alkaline iodide; which are both of them very injurious impurities. But they have never been observed as adulterations in any kind of salt used in Britain.

Actions and Uses.—Chloride of sodium in all its forms is a stimulant and irritant; and from this action most, if not all, of its physiological and therapeutic effects may be deduced. It is a mild irritant, yet not so feeble but that a pound of it taken at once has been known to occasion death. By virtue of this property it is an emetic, when given largely in a state of solution moderately concentrated. To the same property are owing its laxative qualities when taken by the mouth, and its analogous action when given in the way of clyster. It is not an active cathartic singly; but it strengthens the operation of other laxative salts given along with it, as in certain mineral waters, which, like the springs of Airthrey and Pitcaithley in Perthshire, consist chiefly of muriate of lime and muriate of soda with small proportions of other saline laxatives. Farther, as an irritant, chloride of sodium is vermifuge.—As a stimulant, its local may be distinguished from its general action. Externally, it is an approved local stimulant in the form of bath, both hot and cold; and through this stimulus, especially when used in the form of sea-water, it is an energetic tonic, of singular efficacy in some cutaneous eruptions and in struma. Internally it is a necessary topical stimulant for aiding the digestion of the food: and it is serviceable probably in two ways,—by directly stimulating the stomach, and by furnishing the material whence the muriatic acid of the gastric juice is derived. But chloride of sodium also exerts a general or remote ac-

tion through the medium of the blood, of which it constitutes the most abundant salt, and to which it must be furnished in the food, for supplying the waste of it by the various fluid excretions.—The absence of salt in the food leads sooner or later to a cachectic state of the body; and, among other morbid states, an inordinate formation of intestinal worms has been generally observed. In some states of exhaustion from long-continued acute diseases there is an unusual craving for salt; and then a due supply of it has an obvious tonic action. In such conditions it has been supposed that the craving of the patient is an instinct of nature arising from the deficiency of chloride of sodium, as well as of the other saline ingredients in the blood. It has been maintained in recent times that the salts of the blood become deficient in many diseases which tend to put on the characters of adynamia, typhus, or malignity, such as continued fever, yellow fever, typhoid remittent, and malignant cholera. Accordingly some have proposed to restore the deficient salts, and among others the chloride of sodium, by administering them liberally in the usual way, or even injecting them directly into the circulation. The merits of this theory and practice will be found stated under the head of carbonate of soda, which is another of the salts that are defective.——Although a certain proportion of salt is probably indispensable to man, the quantity which is beneficial has its limit. Its use in undue quantity for a length of time was long held to be the cause of scurvy. Few persons are now inclined to regard it as the sole cause of the disease; many on the other hand call in question altogether the dependence of scurvy on too salt a diet. The truth however seems to be, that the disease arises at times from other causes, especially from other dietetic errors; but that where a diet too much abounding in salt concurs with certain co-operating circumstances, among which confinement, damp air, and mental depression are the most conspicuous, scurvy is inevitable.

The dose of chloride of sodium as an emetic is an ounce and a-half or two ounces in half a pint of water. A substitute for a sea-water bath consists of a pound to every three gallons of water.

SODAE PHOSPHAS, *E. L. D.* *Phosphate of Soda.*

Tests, *Edin.* Forty-five grains, dissolved in two fluidounces of boiling distilled water, and precipitated by a solution of fifty grains of carbonate of lead in one fluidounce of pyroligneous acid, will remain precipitable by solution of acetate of lead.

Tests, *Lond.* Exposed to the air it slightly effloresces. It is totally dissolved by water, but not by alcohol. What is thrown down from the solution by chloride of barium is white: the precipitate by nitrate of silver is yellow unless the phosphate has been previously made red hot. Both precipitates are soluble in nitric acid.

Process, *Edin. Dub.* Take of
Bones burnt to whiteness, ten pounds (parts, D.);
Sulphuric acid, two pints and four fluidounces (seven parts, D.);
Carbonate of soda, a sufficiency (eight parts, D.);
Pulverize the bones and mix them with the acid; add gradually six pints (seven parts, D.) of water; digest for three

days, replacing the water which evaporates; add six pints (seven parts, D.) of boiling water, and strain through strong linen; pass more boiling water through the mass on the filter, till it comes away nearly tasteless. Let the impurities subside in the united liquors, pour off the clear fluid, and concentrate to six pints (one-half, D.) Let the impurities again settle; and to the clear liquor, which is to be poured off and heated to ebullition, add carbonate of soda, previously dissolved in boiling water, until the acid be completely neutralized (eight parts, D.) Set the solution aside to cool and crystallize. More crystals will be obtained by successively evaporating, adding a little carbonate of soda till the liquid exerts a feeble alkaline reaction on litmus paper, and then allowing it to cool. (Dissolve again and recrystallize if necessary, D.) Preserve the crystals in well closed vessels.

For. Names.—*Fren.* Phosphate de Soude —*Ital.* Phosphato di soda.—*Ger.* Phosphorsaures Natron.—*Russ.* Phosphornokisloi natr.

Phosphate of Soda (Subphosphate of soda, Sal mirabile) has been long known as one of the salts of the urine; but it was not sufficiently distinguished from other salts till last century, when Rouelle, Proust, and finally Klaproth in 1785, examined and analyzed it (Geiger). The salt used in medicine is all got from bone-earth. The London College have given no process for preparing it, but have admitted it into their Materia Medica.

Chemical History.—Bones consist chiefly of gelatin, phosphate of lime, and carbonate of lime. When burnt at a full red heat, the carbon left by decomposition of the gelatin is gradually consumed, and the earthy salts remain in a state fit for solution in acids. But if a powerful heat be used, the residuum undergoes semivitrification on the surface, and is dissolved by acids with difficulty. When the white bone-earth, well pulverized, is subjected to the action of sulphuric acid slightly diluted, both the carbonate and phosphate of lime are decomposed; sulphate of lime is formed, which remains chiefly insoluble; and the earthy phosphate, parting with a portion of its base, becomes a soluble acid-salt of lime, whose composition is not yet positively known. On the addition of carbonate of soda to the solution of superphosphate of lime, mutual decomposition ensues, carbonic acid escapes, the soda forms phosphate of soda with a part of the phosphoric acid, and the rest of the acid falls down in the form of phosphate of lime. In order to obtain good crystals from the filtered solution, it is necessary that the carbonate of soda be in slight excess.—In operations on the large scale, where it may be advisable to economise the phosphate of lime, the precipitate obtained on adding carbonate of soda, is dissolved in nitric acid; sulphate of soda is then added, and the nitric acid is removed by distillation; upon which a solution of phosphate of soda is obtained, with a deposition of sulphate of lime (Funcke).

Phosphate of soda is sold in beautiful, transparent, colourless crystals, which are rhombic prisms terminated by four converging planes. The crystals have a cooling, mildly-saline taste, very like that of common salt. They effloresce quickly in the air. Heat first fuses them in their water of crystallization; and then the water passes off. But one equivalent of water for every two equivalents of soda is obstinately retained, and cannot be expelled except at a red heat.

When this equivalent is driven off, the salt acquires peculiar properties different from those it possessed originally, being converted into pyro-phosphate of soda (Clark). The cause of the change of property seems to be (Graham), that in the common, or rhombic phosphate, the acid is united, in the proportion of one equivalent, with two of soda and one of water in the capacity of a base, constituting a tribasic phosphate (triphosphate of Turner) of soda and water; and that, when the basic water is expelled by a red heat, the salt becomes a bibasic phosphate (diphosphate of Turner), composed of one equivalent of acid with two of soda, and therefore a totally different compound. Phosphate of soda (rhombic) is soluble in four parts of temperate, and two of boiling water. The solution has some alkaline reaction. It is decomposed by the soluble salts of lime, and phosphate of lime is thrown down. It is also decomposed by the magnesian salts; and if ammonia be likewise present, a very insoluble triple compound is formed, the ammoniaco-magnesian phosphate, one of the varieties of urinary gravel. It yields with nitrate of silver a yellow precipitate, the phosphate of silver, which is soluble in ammonia. It is not acted on if moderately diluted, by ammoniacal nitrate of silver; which constitutes a distinction between the actions of the silver test on this salt and on arsenic in solution. Phosphate of soda consists of two equivalents of soda, one of acid, and twenty-five of water ($2NaO+PO^5+25Aq.$), or, according to the more correct views of Professor Graham, of one equivalent of acid, two of soda, one of basic water, and 24 of crystallization-water ($2NaO+Aq.+PO^5+24Aq.$). It therefore contains 62.6 parts of soda, 71.4 of phosphoric acid, and 225 of water. When a solution of it is evaporated at 90°, the salt crystallizes with only fourteen, instead of twenty-four, equivalents of water of crystallization.

Adulterations.—This salt is seldom wilfully adulterated, but frequently contains traces of sulphuric acid from careless preparation. This impurity will be detected by the precipitate which it forms with baryta, not being entirely soluble in nitric acid, as indicated by the tests of the London College. The other characters given by them chiefly point out the nature of the salt. The Edinburgh College aims at determining the purity of the salt generally, by the quantity of dissolved carbonate of lead required to precipitate it fully. But the College is in error in ordering so much carbonate of lead to be used. Of this salt, as at present met with in British trade (see *Plumbi Carbonas*), 49.27 grains decompose 45 grains phosphate of soda; 49 grains would therefore be a more correct proportion in order to leave a slight excess of phosphate in the fluid. The precipitate ought to be entirely soluble in nitric acid, otherwise sulphuric acid is present.

Actions and Uses.—Phosphate of soda is an excellent saline cathartic, equal in that respect to the most esteemed of the neutral salts, and superior to all of them in the mildness of its taste. The

taste is so purely saline and so weak, that the dose required for a moderate laxative effect may be taken in soup instead of common salt. Unfortunately however it is too expensive for common use.

Its dose is *Phosphas sodæ*, dr. iv. ad dr. x.

SODAE POTASSIO-TARTRAS, *L.* See *Potassæ et Sodæ Tartras.*

SODAE SESQUICARBONAS, *L.* See *Sodæ Bicarbonas.*

SODAE SULPHAS, *E. L. D.* *Sulphate of Soda.*

Tests, *Edin.* Not subject to adulteration.

Tests, *Lond.* It falls to powder in the air: entirely soluble in water, not at all in alcohol: it does not affect litmus or turmeric: a diluted solution is scarcely affected by nitrate of silver, but precipitates abundantly with nitrate of baryta; and the precipitate is insoluble in nitric acid. A strong heat expels fifty-five per cent of water.

Process, *Edin.* Take of
The salt which remains after making
Pure muriatic acid, two pounds;
Boiling water, three pints;
White marble, in powder, a sufficiency.
Dissolve the salt in the water, add the marble so long as effervescence takes place, boil the liquid, and, when neutral, filter it; wash the insoluble matter with boiling water, adding the water to the original liquid; concentrate till a pellicle begins to form, and then let the liquid cool and crystallize.

Process, *Lond.* Take of
The salt remaining after the distillation of Hydrochloric acid, two pounds;
Boiling water, two pints;
Carbonate of soda, a sufficiency.
Dissolve the salt in the water; then add gradually carbonate of soda to neutralize the acid; boil down the liquor till a pellicle appears, filter, and set it aside to crystallize. Pour off the liquor and dry the crystals.

Process, *Dub.* Dissolve the salt remaining after the distillation of muriatic acid in a sufficiency of boiling water; filter the solution, evaporate it, and crystallize the salt by slow cooling.

For. Names.—*Fren.* Sulphate de soude; Sal de Glauber.—*Ital.* Solfato di soda; Sal Glauberiana.—*Span.* Sal de Glaubero.—*Ger.* Schwefelsaures natron; Glaubersalz.—*Swed.* Glaubers-salt.—*Russ.* Sernokisloi natr.—*Hind.* Khari numuk.

Sulphate of Soda, often called Glauber's salt from its discoverer, who made it in 1658, is a very common ingredient of mineral springs of the purgative class, and is also one of the salts met with in small quantity in most terrestrial waters. In some springs it is so abundant, as in that of Païpa among the Andes, that crystals of it are formed upon the soil over which the water is thrown. It is also an abundant artificial production, being a residuum in the manufacture of muriatic acid and chlorine, and being also prepared on a very large scale in the first stage of the process for converting chloride of sodium into carbonate of soda.

Chemical History.—In the processes of the Pharmacopœias, it is obtained from the acid residuum left in the preparation of muriatic acid. The free sulphuric acid is converted into sulphate of soda by neutralization with carbonate of soda, according to the London formula; or, according to that of Edinburgh, it is removed by carbonate of lime, because sulphate of soda is a less valuable article in commerce than the carbonate necessary for making it in the London way.——The neutral salt is then obtained by lixiviation and crystallization.

Sulphate of soda is commonly sold either in the form of small acicular crystals, as obtained by hasty crystallization, or in large oblique rhombic prisms, often truncated on their acute edges so as to form six-sided prisms, and terminated by two, four, or six converging planes. Its crystalline form is the same with that of sulphate of magnesia and sulphate of zinc; which it also resembles otherwise in general appearance. It is colourless and transparent, of a cooling, saline, bitter taste, and strongly efflorescent in the air. Heat fuses it in its water of crystallization, and when raised, quickly drives off all the water except one equivalent, which is retained until the temperature reaches nearly that of redness. At a low red heat this equivalent too passes off, and at a full red heat the salt again fuses. Heated with carbonaceous matter, it is converted into sulphuret of sodium. It is soluble in its own weight of water about 76°, in little more than a third of its weight about 120° (Guy-Lussac), and in its water of crystallization a little above 212°. Its solution is decomposed by the salts of lime, baryta, and lead,—insoluble sulphates being formed; and it is not precipitated by chloride of platinum. The salt is insoluble in alcohol. It is composed of one equivalent of base, one of acid, and ten of water, ($NaO + SO^3 + 10Aq.$); and consequently contains 30.3 parts of soda, 40.1 parts of sulphuric acid, and 90 parts of water. An anhydrous sulphate, crystallizing in opaque prisms, may be obtained by evaporating a solution saturated about 90°, provided care be taken that the temperature do not fall lower.

Sulphate of soda is not subject to adulteration. The characters given by the London College are merely designed for distinguishing it from other salts.

Actions and Uses.—This salt is an excellent purgative, and was long the most favourite saline cathartic in this and other European countries. Since the beginning of the present century, it has gradually been displaced by the sulphate of magnesia. It is given simply in eight or ten ounces of water, to which a few drops of sulphuric acid may be advantageously added, to lessen its bitter taste.

The dose is *Sodæ Sulphas*, dr. iv. a l dr. x.

SODII CHLORIDUM, *L.* See *Sodæ Murias.*

SPIGELIA, *E. L. D.* *Root of Spigelia marilandica, L. W. Spr. Carolina-pink.*

For. Names.—*Fren.* Spigélie de mariland.—*Ital.* Spigelia.—*Port.* Espigelia.—*Ger.* Marilandische spigelie.—*Dan.* Marilandsk ormeurt.

Figures of Spigelia marilandica in Nees von E. Suppl. 52.—Bot. Mag. 80.—Roque, 75.

The virtues of the Carolina-pink were made known to European practitioners a century ago by Drs Lining and Garden.

The plant belongs to the Linnæan class and order *Pentandria*

Monogynia, and to the Natural family *Gentianaceæ*. It is a native of the United States, south of the river Potomac. It is a herbaceous plant, with a perennial, branchy root, which is the only officinal part. This is collected by the Creek and Cherokee Indians. It consists of numerous fibres, which are crooked, wrinkled, branchy, yellowish-brown externally, of a sweetish, bitter, not unpleasant taste, and of a faint peculiar odour. The stems, with their leaves, are often attached to the root as imported into this country. Boiling water readily extracts its sensible qualities. The only important ingredient hitherto found in it by chemical analysis is a bitter extractive matter (Fenuelle) or bitter acrid resin (Wackenroder), which seems the active part of the plant.

The Spigelia has been hitherto used only as an anthelmintic; and though now scarcely employed in this country, it seems from the testimony of American writers to be one of the most powerful of this class of remedies, especially for children. The dose of the powdered root for a child of three years is from ten to twenty grains morning and evening for several days. Or from half an ounce to a whole ounce may be given of the officinal *Infusum spigeliæ* of the United States, which is made by macerating half an ounce of the root in sixteen fluidounces of water for two hours (Wood and Bache). The quantity for adults is four times as much. It is generally said to possess narcotic properties in large doses, and to have sometimes proved even fatal to children,—giddiness, dimness of sight, dilated pupils, and convulsions being the prominent symptoms. But these effects have been probably exaggerated. They are at variance with the properties of the Natural family of plants to which the Spigelia belongs.—The bitter extractive principle of Fenuelle was found by him to cause symptoms like those of intoxication, and also to act as a purgative.—Dr Bonyun of Demerara says that the *Spigelia anthelmintica* of that settlement, probably the first species used in Europe, is a much more powerful vermifuge than the Carolina plant, especially if it be used fresh; in which state two or three leaves are a sufficient dose.

SPIRITUS AETHERIS NITRICI. See *Aether nitrosus.*

SPIRITUS RECTIFICATUS *et* TENUIOR. See *Alcohol.*

SPONGIA, *E. L. D.* *Spongia officinalis Linn.* *Sponge.*

PULVIS SPONGIAE USTAE, D.

PROCESS, *Dub.* Cut the sponge in pieces, so as to free it from small stones; burn it in a covered iron vessel, until it become black and friable; afterwards reduce it to a very fine powder.

SPONGE has been in use from time immemorial by surgeons. It belongs to the class of Zoophytes.

It consists entirely of an intricate web of very fine flexible corneous fibres, in variously formed masses, porous, light, elastic,

bibulous, of a yellowish-brown colour, and generally containing sand and fragments of stone or coral. The best sponges, sold as Turkey sponge, come from the Grecian archipelago; an inferior sort with coarser fibre and larger pores is sold as Bahama sponge.

Good sponge, invaluable to the operating surgeon, should be soft, elastic, very bibulous, and free from all stony or hard particles. Sponge tent, formerly much used for dilating sinuses, but now chiefly employed for expanding the os uteri, to induce labour, or to permit exploration of the cavity of that organ, is best prepared in the following manner. A piece of clean soft sponge is soaked in a mixture of one part of mucilage and two of water; it is then bound up very tight with a strong string, and in this compressed condition is dried thoroughly in a stove; the string is removed, and the tent being cut into the form desired is dipped in a mixture of one part of wax, one of resin, and four of lard.

Sponge contains a trace of combined iodine, and before the discovery of this element and its compounds was, in the charred state, a remedy of some repute in scrofula and goitre. Its use internally however is now obsolete. The dose of burned sponge was from a drachm to an ounce.

STANNUM, *E. L. D.* *Tin.*

STANNI PULVIS, *E. L. D.* *Powder of Tin.*

TESTS, *Edin.* Three fluidrachms of commercial nitric acid convert one hundred grains entirely into white powder; and distilled water, boiled with this powder and filtered, yields no precipitate with solution of sulphate of magnesia.

TESTS, *Lond.* Entirely soluble in boiling hydrochloric acid; solution colourless, but rendered purple by chloride of gold, and yields a white precipitate to potash, soluble in an excess of the test: Density 7.29.

PROCESS, *Edin.* Melt tin in an iron vessel; pour it into a mortar previously heated rather above the fusing point of the metal; triturate briskly as it cools, ceasing as soon as a considerable proportion is finely pulverized; sift the product, and repeat the process with what is left in the sieve.

PROCESS, *Dub.* Take any quantity of very pure tin, melt it and agitate it strongly till it be pulverized; then sift it.

FOR. NAMES.—*Fren.* Etain.—*Ital.* Stagno.—*Span.* Estano.—*Port.* Estanho.—*Ger.* Zinn.—*Dut.* Tin.—*Swed.* Tenn.—*Dan.* Tin.—*Russ.* Olovo.—*Arab.* Resas.—*Pers.* Urseez.—*Tam.* Tagarum.—*Beng.* Runga.

Natural and Chemical History.—TIN is found in the form of various ores, of which tin-pyrites and tinstone are the most important. In the former this metal is united with sulphur and copper, in the latter with oxygen and silica; but there are also many impurities, especially iron and arsenic. It is obtained from its ores by the usual process of reduction with carbonaceous matter. There are two qualities in commerce, called Block-tin and Grain-tin, of which the latter obtained from a very pure tinstone, is the finer in quality. Tin is distinguished from other metals by its peculiar bluish-white colour, which slightly tarnishes under exposure,—by its malleability, which allows of its being beaten into very fine foil,

—by its softness and want of elasticity,—and by its easy fusibility. Its density is variously stated between 7.285 and 7.9. It is unusually impure if of the latter density; the common tin of the shops is about 7.56; and the greater its purity the lower is its density. It fuses at 442°, and in this state quickly oxidates and acquires a gray crust. At a red heat it burns brightly. The best character for recognizing it is the effect of nitric or nitrous acid. Fuming nitrous acid in its concentrated state, or nitric acid slightly diluted, immediately acts on its powder with great violence; orange fumes are copiously disengaged, together with considerable heat; and a white powder is left, which is peroxide of tin.

Tin being used in medicine in the form of powder, the Edinburgh and Dublin Colleges have properly given a process for pulverizing it, which the London College however has neglected. It is impossible to reduce tin to powder by trituration at ordinary temperatures. But this may be accomplished on the large scale by fusing it in a broad iron vessel and switching it briskly with a broom as it cools; and on the small scale by agitating it while fused, in a wooden box rubbed inside with chalk. The latter method is that usually practised, and is probably the plan intended by the directions of the Dublin College. A finer powder however may be more quickly obtained by pouring the melted metal, as directed by the Edinburgh Pharmacopœia, into a hot mortar, and triturating it for a few seconds while it is in the act of concreting. The success of this process depends on the mortar being hot enough to preserve the metal for a short time in a state of fusion, and upon the operator ceasing the trituration in proper time, otherwise the particles are made to accrete again. By sifting the product and repeating the process with the coarser particles left in the sieve, it is easy to obtain a powder considerably finer than sea-sand. The powder of the shops is often insufficiently fine for medical use.

Adulterations.—Tin powder is subject to be adulterated with lead; and not unfrequently lead powder is sold instead of it. This adulteration and substitution are easily met by the tests in the Edinburgh formula. After the action of an excess of nitric acid, it will be found that either no white oxide of tin is formed, or that when the powder produced is washed with boiling distilled water, the water gives an abundant white precipitate of sulphate of lead when treated with solution of sulphate of magnesia. The system of tests in the London formula will not detect the presence of lead; they seem chiefly indeed intended for determining that a given substance is tin; and even for this purpose they are not so convenient as the method by nitric acid.

Actions and Uses.—Tin was introduced into medical practice by Dr Alston, the first Professor of Materia Medica in the University of Edinburgh; and it has since been currently employed as an anthelmintic. The method of administering it is to give at least half an ounce of the powder every morning for three successive

days, while the stomach is empty; and then to carry it off by means of a brisk purgative. It is given in the form of electuary made up with treacle or with orange-confection. It is undoubtedly an effectual remedy in cases of ascarides and lumbrici, but is less frequently successful in tænia. It has indeed fallen into discredit with many even for other kinds of intestinal worms; but those who find it to fail must blame either the small doses administered, or the coarse state of powder in which it is often kept; for it has appeared to me almost always effectual, especially in the ascarides and lumbricus of children. Its action is in all probability mechanical only; at least there is no property in the intestinal secretions or other contents, in consequence of which the tin could be dissolved; and besides, the worms are always alive when discharged.

The only pharmaceutic form is the *Pulvis stanni*, of which the dose is unc. ss. ad unc. i.

STAPHISAGRIA, *E. L.* STAPHISAGRIÆ SEMINA, *D.*

Seeds of Delphinium Staphisagria (L. W. DC. Spr.) Stavesacre.

For. Names.—*Fren.* Staphisaigre.—*Ital.* Stafisagria.—*Span.* Estafisagria; Albarraz.—*Port.* Alvarraz.—*Ger.* Stephanskraut.—*Dut.* Luikruids.—*Swed.* Staffansört; Lus ört.—*Dan.* Luus-urt.

Figures of Delphinium Staphisagria in Nees von E. 394.—Roque, 128.—Steph. and Ch. ii. 55.

Stavesacre is the Σταφις αγρια of Dioscorides.

Natural and Chemical History.—It is the seed of a species belonging to the same genus with the Larkspur of our gardens. It is arranged in the Linnæan class and order *Polyandria Trigynia*, and in the Natural classification among the *Ranunculaceæ.* It is a native of the south of Europe. It is a biennial, which puts forth a tall stem covered with numerous fine blue flowers. The seed, its officinal part, is about the size of a grain of wheat, somewhat triangular, rough and dark-brown on the exterior, of a feeble odour, but of a strong, bitterish, nauseous taste. Pelletier and Caventou in France, and about the same time Brandes in Germany, discovered in the seed an alkaloidal principle, which has been called Delphinia, and which according to Brandes amounts to eight per cent of the entire seed. The other principles are a concrete fixed-oil, chlorophyll, albumen, and a considerable variety of salts. Delphinia is obtained by bruising the seeds into a paste, exhausting this with boiling rectified-spirit, distilling off the spirit, dissolving the residuum in boiling water acidulated with sulphuric acid, and precipitating the solution by ammonia. The impure alkaloid thus prepared is rendered purer by digesting its alcoholic solution with animal charcoal, and evaporating off the spirit (Couerbe). It still however continues not altogether pure, and in particular is mixed with another alkaloidal principle, which has been named Stephysain.

Delphinia is solid, yellowish, not crystallizable, fusible, insoluble in water, soluble in alcohol, more so in ether, and of a strong acrid, bitterish taste. It unites with and neutralizes acids, forming very bitter, acrid, uncrystallizable salts. Its constitution is believed to be C^{27} H^{19} O^{2} N (Couerbe). It is the active ingredient of the seeds.

Actions and Uses.—Stavesacre is an irritant, emetic, cathartic, and narcotic. In large doses it acts as an irritant poison. It was used by the ancients as a cathartic for general purposes, but is too violent, painful, and uncertain in its operation for modern practice. Neither is it more eligible as an emetic, though formerly employed as such. It is not a bad anthelmintic however, and may be advantageously used for that purpose in the form of infusion, both by the mouth, and as a clyster. But its chief application in the present day is for the destruction of lice on the body. These vermin are promptly killed by a lotion made with an infusion of the bruised seeds in vinegar, or by a salve made with the seeds and four times their weight of lard very carefully beat together.——The alkaloid delphinia is endowed in an eminent degree with the peculiar properties of the seed. Six grains of it dissolved in vinegar will kill a dog in forty minutes; and the symptoms are vomiting, giddiness, and slight convulsions. Attempts have lately been made to introduce it into medical practice; but nothing certain is known of its medicinal actions.

STRAMONIUM, *E.* *Herb of Datura Stramonium, L. W. Spr. Thorn-apple* (Edin.)

STRAMONII FOLIA *et* SEMINA, *L. D.* *The leaves and seeds of Datura Stramonium, &c.* (Lond. Dub.)

EXTRACTUM STRAMONII, E. L. D.

PROCESS, *Edin.* Take of Stramonium seeds, any convenient quantity; grind them well in a coffee-mill; rub the powder into a thick mass with proof-spirit; put the pulp into a percolator, and transmit proof-spirit till it passes colourless. Distil off the spirit, and evaporate what remains in the vapour-bath to a proper consistence.

PROCESS, *Lond. Dub.* Take of Stramonium seeds, 15 (12, D.) ounces; Boiling distilled water, a gallon (old wine measure, D.)
Digest for four hours in a covered vessel; take out the seeds and bruise them in an earthen mortar; replace them in the water, boil down to four pints, strain the liquor while hot, and evaporate it to the proper consistence.

FOR NAMES.—*Fren.* Stramonium; Pomme épineuse.—*Ital.* Stramonio; Datura.—*Span.* Estramonio.—*Port.* Estrammonio.—*Ger.* Stechapfel; Dorn-apfel.—*Dut.* Doorn-appel.—*Swed.* Spikklubört.—*Dan.* Galurt.—*Russ.* Durman; Pianie ogurtsi.

Datura fastuosa.—*Arab.* Kechu-booh.—*Pers.* Goozgiah; Bunjdeshtee.—*Tam.* Karoo oomatay.—*Sansc.* Dhatura.—*Beng.* and *Hind.* Kala dhootura.

FIGURES of Datura Stramonium in Nees von E. 193.—Hayne, iv. 7.—Engl. Bot. 1288.—Roque, 62.

SEVERAL species of *Datura*, closely resembling the officinal

thorn-apple in external characters and physiological action, have been long known as poisons and used as remedies in the East-Indies, where they are indigenous. But the European officinal species was first introduced into medicine, along with other narcotic vegetables by Störck in 1762. The Στρυχνον μανικον of Dioscorides, supposed by some to be at least a species of Datura, does not correspond, according to his description, with any known plant of the

Natural History.—The *Datura Stramonium* belongs to the Linnæan class and order *Pentandria Monogynia*, and to the Natural family *Solanaceæ.* Its native country is unknown. It is met with in various parts of Asia, and apparently wild on rubbish, roadsides and fields throughout most of Europe, and even also in North America. Fuchs, one of the first European authors, who mentions and figures the plant, says in 1542 that it was introduced into Germany from Italy: and about the close of the same century Gerard tells us that it was introduced by himself through Lord Zouch from Constantinople into England, where it now occurs in various parts of the country as if indigenous. It is a herbaceous annual, towards three feet in height, with a leafy, branchy stem, large, ovate, sinuous, deeply-cut leaves, and long, white, axillary, trumpet-shaped flowers, which appear in July and August. The flowers are succeeded by a capsule, about the size of a hen's egg, covered with long prickles, four-celled, and filled with numerous brownish-black, rough, flat, reniform seeds, somewhat less than a lupin. Almost every part of the plant has been used medicinally, such as the leaves, twigs, seeds and roots. But the true officinal parts are the leaves and seeds. The leaves are gathered when the flowers are full-blown. They have a heavy odour when fresh, and more especially while drying, and their taste is mawkish, rather bitter and nauseous. The seeds sometimes fail to ripen in this climate, and are then pale grayish-brown. When ripe they are brownish-black, feebly bitter and mawkish to the taste, but without odour unless they be bruised, when they emit the peculiar heavy odour of the herb.

Chemical History.—Both seeds and leaves yield their active properties to water, spirit, and fixed oils. Water is used by the English and Irish Colleges for obtaining the *Extractum stramonii* from the seeds; but proof-spirit, recommended by the Edinburgh College, is a better menstruum for the purpose, because the active part of stramonium, like that of other solanaceous narcotics, is partly decomposed by the prolonged heat required for an aqueous extract. The watery extract amounts to an eighth, the spirituous extract to a seventh, of the weight of the seeds. A tincture of the seeds, a good officinal form, which has been adopted in the United States Pharmacopœia, is prepared with one ounce troy of seeds to eight fluidounces of proof-spirit. Fixed oil may be impregnated with the properties of the plant by heating the leaves in it; and in this way is

prepared a liniment of anodyne virtues, which is used in some parts of Germany.——The analysis and composition of Stramonium have been investigated by Promnitz, by Brandes, and by Geiger and Hesse. Promnitz examined the leaves without any important result. Brandes found in the seeds fixed oil, resin, gum, extractive, lignin, phyteumacol, albumen, various salts and an active principle which he called Daturin, but which no other chemist could obtain by his process. In 1833 Geiger and Hesse obtained the true Daturia by exhausting the bruised seeds with boiling rectified-spirit, and then proceeding as for the active principle of hyoscyamus. It is crystalline, without odour, of a bitterish, tobacco-like taste, alkaline in its reactions, partially volatilizable at a moderate heat, not volatilizable when boiled in water, sparingly soluble in water, except at a boiling temperature, more so in ether, easily soluble in alcohol, and capable of forming crystalline salts with acids. Its constitution is unknown.—Stramonium is one of the narcotic vegetables in which Dr Morries obtained by destructive distillation a poisonous oil, composed of an inert true oil in union with an active principle, probably a modification of Daturia.

Actions and Uses.—The leaves and seeds of stramonium are powerfully narcotic in large doses, and produce nearly the same effects as henbane and belladonna,—that is, at first dryness of the throat and delirium, or a state like somnambulism, and afterwards profound coma with dilated pupils and sometimes convulsions. One hundred seeds have proved fatal to a child of two years in twenty-four-hours. It is said to be used as a poison in the East for various nefarious purposes, and in Russia for increasing the intoxicating effects of beer. The physiological action of medicinal doses is not so well understood. But it seems to be, like hyoscyamus, an anodyne and antispasmodic, to act in this way without constipating the bowels, and to be sometimes serviceable where opium does not answer. It is a doubtful hypnotic, except simply through means of its anodyne action. It sometimes causes nausea, and generally a peculiar indescribable sensation in the head.—It has been used both inwardly and outwardly for allaying the pain of chronic rheumatism and neuralgia, and undoubtedly at times with good effect (Marcet, Begbie). Some have recommended it internally as a calmative in mania and epilepsy (Störck). The chief application of it however in recent times has been the method, introduced from India, of inhaling its smoke as a remedy for the asthmatic paroxysm, and the fits of dyspnœa which occur in emphysema of the lungs and organic diseases of the heart. It is often serviceable in these affections, but loses its effect by frequent use. It must be given with caution; for too large doses are dangerous. The effects of the herb in the form of smoke are easily intelligible on considering the observations of Dr Morries on the properties of the empyreumatic oil, and those of Geiger on the effects of heat upon Daturia. This method of using stramonium must have been known at an early

period in Europe; for in 1542 Fuchs mentions that its vernacular name in Germany was Rauch-apfelkraut (Smoke-applewort).

Daturia is so energetic a poison that an eighth of a grain will kill a sparrow in three hours, and nearly proved fatal to a cat when applied to the eye. Very minute quantities applied to the eye occasion protracted and excessive dilatation of the pupil.

The doses of the preparations of stramonium are: *Stramonii foliorum pulvis*, gr. i. ad gr. v.—*Stramonii seminum pulvis*, gr. i. ad gr. v.—*Extractum stramonii*, gr. $\frac{1}{4}$ ad gr. iii.—*Stramonii folia*, gr. x. ad dr. ss. for smoking. Cigars have been of late conveniently made in London for smoking.—*Stramonii tinctura* (United States Ph.) min. x. ad min. xxx.

STRYCHNIA, *E. L.* *Strychnia.* *Always more or less impure* (Edin.)

TESTS, *Edin.* Intensely bitter: nitric acid strongly reddens it: a solution of ten grains in four fluidrachms of water by means of a fluidrachm of pyroligneous acid, when decomposed by one fluidounce of concentrated solution of carbonate of soda, yields on brisk agitation an adhesive mass, weighing when dry ten grains, and entirely soluble in solution of oxalic acid.

TESTS, *Lond.* Crystalline. Readily soluble in boiling alcohol, not in water; fusible and entirely consumed by a higher heat.—To be used with caution, being a violent poison.

PROCESS, *Edin.* Take of
Nux-vomica, one pound;
Quicklime, an ounce and a half;
Rectified-spirit, a sufficiency.
Subject the nux-vomica for two hours to the vapour of steam, chop or slice it, dry it thoroughly in the vapour-bath or hot-air press, and immediately grind it in a coffee-mill. Macerate it for twelve hours in two pints of water and boil it; strain through linen or calico, and squeeze the residuum; repeat the maceration and decoction twice with a pint and a-half of water. Concentrate the decoctions to the consistence of thin syrup; add the lime in the form of milk of lime; dry the precipitate in the vapour-bath, pulverize it, and boil it with successive portions of rectified-spirit, till the spirit ceases to acquire a bitter taste. Distil off the spirit till the residuum be sufficiently concentrated to crystallize on cooling. Purify the crystals by repeated crystallizations.

PROCESS, *Lond.* Take of
Nux-vomica, bruised, two pounds;
Rectified-spirit, three gallons
Diluted sulphuric acid, and
Magnesia, of each a sufficiency.
Boil the nux-vomica with a gallon of the spirit in a retort with a receiver adapted. Pour off the liquor; boil the residue with another gallon of spirit and that which had distilled; repeat the process; squeeze the residue; distil the spirit from the united tinctures, and concentrate sufficiently what remains. Dissolve this in cold water, filter, and concentrate with a gentle heat to the thickness of syrup. Gradually saturate this with magnesia while hot, stirring constantly; set the mixture aside for two days; then strain through cloth, and express the residue. Boil this in spirit, filter, and distil off the spirit. Add to the residuum a little diluted sulphuric acid with water; digest with a gentle heat, and set it aside for twenty-four hours to crystallize. Express and dissolve the crystals in water, and add ammonia, with agitation, to throw down Strychnia. Dissolve this in boiling spirit to obtain pure crystals.

FOR. NAMES.—The term Strychnin, or Strychnina, has been adopted in most modern European languages.

STRYCHNIA, one of the vegetable alkaloids, was discovered in 1818 by Pelletier and Caventou in nux-vomica and the St Igna-

tius-bean, the seeds of *Strychnos Nux-vomica* and *S. Ignatia.* It has been since found also in the bark of the former plant, in the seeds of *S. colubrina* or snake-wood, and in the Java poison called Chettik or Tieuté obtained from the *S. Tieuté;* and it has been likewise announced as existing in the Wourali poison of Guiana, which is supposed to owe its properties chiefly to the juice of a fifth species of the same genus, the *S. guianensis*, or *S. toxicaria*, Schomburgk.

Chemical History.—The strychnia of the shops is at present obtained only from nux-vomica. But it exists in larger proportion in the St Ignatius-bean, a scarce substance in European commerce; and I am inclined to think from some trials, that it may also be extracted more profitably from the bark of the nux-vomica tree than from its seeds. The process for preparing it from nux-vomica consists essentially in first obtaining, either directly or through the medium of an alcoholic extract, a concentrated watery solution of its active salt the igasurate of strychnia, in union with various other principles,—in then decomposing this salt by means of caustic lime or magnesia,—and lastly in dissolving from the precipitate, by boiling rectified-spirit, an impure strychnia, which is subsequently purified by repeatedly crystalling it from its spirituous solution, with or without the aid of animal charcoal as a decolorizing agent. Every process hitherto published is tedious, troublesome and unproductive. It is said that, by subjecting the coarse powder of nux-vomica with water to fermentation with yeast for 20 days, the subsequent process is much facilitated (Molyn). The proportion of strychnia, even in the crude or somewhat impure state, is seldom above a 200th part of the seeds. The St Ignatius-bean however yields so much as 1.4 per cent (Geiseler). It is scarcely necessary to repeat or explain here the details of the processes adopted by the two British Colleges, as their nature is sufficiently apparent from the particulars of the formulæ. That of the Edinburgh Pharmacopœia, adopted from the process of Henri, is the more economical of the two, inasmuch as it avoids the use of large quantities of spirit. And it has the farther advantage of pointing out how nux-vomica may be reduced to a state of sufficiently fine division; which, on account of its horny toughness, is by no means so easy a matter as might be supposed from the brief directions of the London College to use the seeds "bruised." The product of either process is an obscurely-crystalline granular powder, grayish-white, seldom snow-white, and generally, as the Edinburgh College indicates, more or less impure in the state in which it is now manufactured for the druggist.

In this state, strychnia is a composite body, consisting of nearly equal proportions of the two alkaloids of nux-vomica, strychnia and brucia, together with more or less colouring matter. From this substance the alkaloids may be obtained apart from one another, and perfectly pure, in the following manner. Nitric acid very

much diluted is neutralized with the strychnia of the shops; and the solution, after being filtered, is concentrated for crystallization. Nitrate of brucia then crystallizes in short, thick, dense prisms grouped together, and nitrate of strychnia in radiated tufts of long, light, silky, capillary needles; so that, on gently agitating the fluid to break up the crystals, the latter salt may be poured off with the mother-liquor, while the salt of brucia remains behind in the vessel. Each salt may then be dissolved in water, decolorized by animal charcoal, and decomposed with ammonia; and the precipitate thus obtained may be crystallized by cooling a hot solution of it in rectified-spirit.

Pure strychnia readily crystallizes in elongated, oblique, colourless octaëdres. It is permanent in the air, fusible like a resin, destructible by a heat under that of redness, destitute of odour, but possessed of a bitter taste so intense as to be communicated to water containing only an 80,000th part of it. It is moderately soluble in fixed and volatile oils, and in boiling rectified-spirit, insoluble in pure alcohol or ether, almost insoluble in cold water, and soluble in 2500 parts of boiling water. It is alkaline in its relations to vegetable colours, and forms with acids definite and in general crystallizable salts. Nitric acid does not redden it, if it be quite free of brucia. A convenient test for it has been proposed by Marchand. This consists in dissolving it in sulphuric acid containing a hundredth of nitric acid, and then adding peroxide of lead; upon which there arises a splendid blue colour, passing through violet and red into permanent siskin-green. It has been analyzed by various chemists, with discrepant results, its atomic weight not being definitely settled. Liebig and Gerhardt agree in ascribing to it the constitution 44 equivalents of carbon, 24 of hydrogen, 4 of oxygen, and 2 of azote ($C^{44} H^{24} O^4 N^2$) [$C^{22} H^{12} O^2 N$?].

Pure Brucia cannot easily be obtained in any other crystalline form than that of small, delicate, pearly, colourless scales. It is most intensely bitter. It fuses a little above 212°. It is easily soluble in boiling alcohol, insoluble in ether, sparingly soluble in volatile oils; and cold water dissolves about an 850th of its weight. It acts like an alkali on vegetable colours, and forms crystallizable salts with acids. Nitric acid renders it deep yellow or orange-red; and this colour is destroyed by dcoxidating agents, such as sulphuretted-hydrogen and sulphurous acid. The crystals consist of one equivalent of brucia and six equivalents, or seventeen per cent, of water. The anhydrous alkaloid is probably composed of 46 equivalents of carbon, 26 of hydrogen, 8 of oxygen, and 2 of azote ($C^{46} H^{26} O^8 N^2$) (Regnault).

The strychnia recognised by the London and Edinburgh Colleges is the impure drug, consisting of strychnia, brucia, and colouring matter. For a long time no other kind was to be found in the shops. But the pure alkaloid is now easily obtained, and ought alone to be recognised, as there is no other way of securing

uniformity of strength. The impure Strychnia of the shops may be known by its pale-gray colour of variable shades, its overpowering persistent bitter taste, the effect of nitric acid in reddening it, and the formation of the crystallized nitrates of brucia and strychnia by the process described above.

Adulterations.—On account of its high price, strychnia is much subject to adulteration. This is a serious circumstance, considering the irregularity thus caused in the strength of a most energetic drug and poison. In strict language officinal strychnia is seldom met with in the shops otherwise than adulterated. But, besides the brucia and colouring matter legitimately present, it often contains, through faulty preparation, a larger proportion of colouring matter than usual; and sometimes lime or magnesia is mixed with it. The formula of tests given by the Edinburgh College will detect these impurities. When it is dissolved in diluted acetic acid, and thrown down again with an excess of carbonate of soda, it may be collected in a single mass by brisk agitation; and this when dried weighs as much as the strychnia did originally, if not more impure than usual; and if there be no admixture of lime or magnesia, it is entirely dissolved by oxalic acid in solution. The London directions will not detect overabundant colouring matter, which is the most common impurity.

Actions and Uses.—Strychnia belongs to that denomination of narcotics which act chiefly, if not solely, by stimulating the spinal chord and medulla oblongata, and without affecting the functions of the brain. The slightest observable effects from small doses are twitches of the muscles of the arms and legs, occurring especially during sleep, and accompanied with restlessness, some anxiety, acceleration of the pulse, and generally slight perspiration. More rarely the bowels present increased activity; the urine is either augmented or discharged more frequently; and the venereal appetite is promoted. Larger doses cause more violent starting of the muscles, or even also a tendency to locked-jaw; which are succeeded by stiffness, weariness, pain or rending in the limbs. In their highest degree, these effects amount to violent tetanic spasm, occurring in frequent fits, with brief intervals of repose, acute sensibility, and dreadful alarm. Strychnia exerts this action more or less, through whatever organ or texture it is introduced into the body. It operates with an energy proportioned to the activity of absorption where it is applied, and hence most energetically when introduced into a vein, and in the next place when applied to a recent wound. The blood of an animal suffering under it will affect another animal similarly, if transfused into its veins. It is one of the most subtle of poisons. I have seen a wild boar killed in ten minutes with a third part of a grain of commercial strychnia injected into the cavity of the chest; I have known two-thirds of a grain cause alarming locked-jaw and general spasms in the human subject when swallowed; one grain introduced into a wound would

probably prove fatal to a man; and Pelletier and Caventou have killed a dog in thirty seconds with the sixth of a grain of the pure alkaloid. It is not a cumulative poison, like mercury or digitalis. On the other hand its activity does not diminish, like that of opium, under the influence of habit. There is no antidote for it.

The chief practical application of these singular properties is to the treatment of the different varieties of chronic palsy, such as hemiplegia, paraplegia, partial paralysis of particular joints or particular muscles, amaurosis, and palsy of the bladder. Strychnia must not be used in recent cases, or while general reaction prevails, or when signs exist either of local irritation in the brain or spinal chord, or of determination of blood towards the head. It is usually given once, twice, or thrice a day, in doses gradually increased till some physiological effect appear, especially starting of the limbs. The paralysed muscles are always first affected, if they are thrown into spasms at all. If the remedy is to succeed, improvement begins speedily,—sometimes the day after the first fits of spasm; and hence a fortnight's treatment will decide what is to be the probable result. The cure may be at times perfected quickly; but more generally, though amendment may show itself soon, complete recovery is not attained without persevering for many weeks or even months. This treatment is successful at times even in very old cases, more generally in paraplegia than hemiplegia, much more frequently in cases of complete than of incomplete paralysis, occasionally in palsy of the bladder, seldom in other local palsies, and not often in amaurosis. Of 97 cases of hemiplegia or paraplegia, collected by Bayle or treated by Dr Bardsley, Jun., 59 got quite well, and 25 greatly better. My own experience has been much less favourable. Yet I have several times seen hemiplegia and paraplegia, and in one instance incontinence of urine, in which it has been found useful by others (Pitschaft), apparently cured by strychnia: At least the first signs of amendment immediately succeeded the first signs of its physiological action.

Strychnia, or some drug containing it, such as nux-vomica or St Ignatius-bean, has also been used in the treatment of epilepsy, amenorrhœa, ague, dysentery and rheumatism. Dr Weitz, a physician of Nurenberg, long celebrated throughout Germany for his success in curing epilepsy with a secret nostrum, was found after his death to have employed the St Ignatius-bean.—Dr Bardsley speaks favourably of the trials he made with strychnia in amenorrhœa. Hufeland, and a Swedish physician Haystrom, found nux-vomica an effectual remedy in severe epidemic dysentery. And there is no doubt that the same drug is one of the many bitters, which occasionally succeed in arresting intermittent fever.

Strychnia must be administered with great caution and constant observation of the patient,—not merely because of its tremendous activity as a poison, but likewise on account of its variable strength. It is usually given in the form of pill with bread-crumb, beginning

with a sixth of a grain, and increasing the dose gradually every other day till muscular twitches are produced. After this it is seldom necessary to increase the doses, but sometimes advisable to discontinue them for a day or two when the effects are unusually severe. There is little use in giving it oftener than once in twenty-four hours, namely in the evening; for starting of the muscles is always produced most easily during the night-time, and not more easily when additional doses are given through the day. When the sample of the drug is changed, as it may be stronger, its dose should be diminished to two thirds. Should severe spasms or restlessness be induced, a full opiate will arrest them. Strychnia may also be applied externally through means of a fresh blistered surface. This is the most approved mode of treating amaurosis (Shortt), and has given relief in facial neuralgia (Maclagan). From a twelfth of a grain to a grain in fine powder should be sprinkled over the blistered part once or twice a-day; and when the surface suppurates, a fresh blister must be applied on a neighbouring spot.

Brucia acts precisely as strychnia, but much less energetically. Different experimentalists fix its relative strength between one-sixth and one twenty-fourth of that of strychnia.

The doses of commercial Strychnia vary from gr. $\frac{1}{6}$ to gr. i. internally, and gr. i. to gr. v. externally.

STYRAX, *E. L. D.* *Balsamic exudation of Styrax officinale, L. W. Spr.* *Storax.*

EXTRACTUM STYRACIS, E.

PROCESS, *Edin.* Take any convenient quantity of Storax in fine powder; exhaust it by boiling it in successive quantities of rectified-spirit; filter the spirituous solutions, distil off most of the spirit, and evaporate the remainder over the vapour-bath to the consistence of thin extract.

STYRAX PURIFICATUM, L.

PROCESS, *Lond.* Dissolve Storax in rectified-spirit; strain; distil off the spirit with a gentle heat, to the proper consistence.

PILULAE STYRACIS. See *Opium.*

FOR. NAMES.—*Fren.* Storax.—*Ital.* Storace.—*Span.* Estoraque.—*Port.* Storaque.—*Ger.* Aechte Storax.—*Dut.* Styrax.—*Swed. Dan.* Storax.—*Arab.* Usteruk.

FIGURES of Styrax officinale in Nees von E. 210.—Hayne, xi. 23.—Steph. and Ch. ii. 47.

STORAX was known to the Greek physicians under the name of Στυραξ, and has been employed in medicine ever since; but it is now put to little use.

Natural History.—The plant supposed to produce it, the *Styrax officinale,* belongs to the Linnæan class and order *Dodecandria Monogynia,* and to the Natural family *Styraceæ* of Lindley. It is a low tree inhabiting Syria, Arabia, the Grecian continent and Archipelago, Italy, and other parts of the south of Europe. It thrives tolerably well in the south of England. In Syria, whence the storax of commerce is thought to be derived, the tree is said to yield the drug in the form of a balsamic resinous juice, after the punctures of insects, or incisions made expressly with a knife. But

no positive knowledge is possessed on this head; because the natives who collect storax make a mystery of their whole proceedings (Ehrenberg). It is imported into Britain from Trieste (Pereira).

A variety of substances are occasionally seen in the drug market under the name of Storax; and Dr Pereira has mentioned no fewer than nine, of which however it will be sufficient to mention here two only, as the rest are very seldom met with. These are Common and Liquid storax.——Common storax occurs in brittle, almost turf-like cakes, several pounds in weight, reddish-brown in colour, possessing a peculiar, balsamic agreeable odour like that of vanilla or balsam of Peru, and composed apparently of saw-dust cemented by a resinous matter. It acquires when exposed to the air a whitish efflorescent film of benzoic acid. The cakes may be easily crushed to a coarse powder, in which state storax is commonly met with in retail shops. In consequence of always containing foreign admixtures, it must be purified by preparing from it an alcoholic extract, as the Edinburgh and London Colleges have directed; and it is well not to carry the concentration too far, because in this way the fragrant principle is better retained, and the extract is obtained in a fitter state for making pills. Storax consists of a trace of volatile oil, a little gum, some extractive matter, much woody fibre, with from 33 to 54 per cent of resin, and from 1 to 2.6 per cent of benzoic acid (Reinsch).——Liquid storax, which is stated by Dr Pereira also to come from Trieste, has not been accurately traced to its botanical source, but is supposed to be got from a species of *Liquidambar*, a plant of the Natural family *Balsamaceæ*. The manner of collecting this variety of storax has been recently described by Landerer of Athens. The plant, he says, inhabits both the mainland and islands of Greece; but on the mainland it is a scentless shrub, incapable of yielding any balsam; while on the islands of Chio and Rhodes, where it is called *Βουχουρι*, it exhales a rich odour of vanilla in the flowering season, and yields liquid storax from its bark and young twigs. These are formed into balls, which are squeezed in a heated press; and thus is obtained a gray oily matter called Buchuri-jag or oil of buchuri, which is exported pure, or made into cakes with finely powdered olibanum. A coarser and blacker oil is obtained from the residuum by stronger pressure at a higher temperature (Buchner's Repert.). The only variety of liquid storax generally met with in English trade is an opaque, gray substance, like bird-lime in consistence (Pereira), possessing the same odour as common storax, and containing nearly the same principles.

Actions and Uses.—Storax is a stimulant. In common with other balsamic resins, it long enjoyed high reputation as a pectoral remedy. It is now used solely on account of its fragrance, for compounding ointments and pills. It is an excellent addition to opium in the form of pill; for it covers the strong odour and taste of that drug better perhaps than any thing else. Hence it has been

properly adopted by all the Colleges for one of the officinal pills of opium,—the *Pilula styracis;* the name of which also enables the practitioner to administer opium, when necessary, without the patient's knowledge.

SUCCINUM, *L. D.* *Amber.*

ACIDUM SUCCINICUM, L. D.

PROCESS, *Dub.* Take of
Amber, in coarse powder, and
Pure sand, of each one part.
Obtain by distillation, with a gradually-increasing heat, an acid liquor, an oil, and an acid in crystals. Compress the crystals in bibulous paper, and sublime them a second time. The oil may be detached from the acid liquor by filtration.

OLEUM SUCCINI, L. D.

PROCESS, *Lond.* Apply a gradually-increasing heat to amber in an alembic, by means of a sandbath, till there are obtained an acid liquor, an oil, and an oily salt. Distil the oil by itself twice.
PROCESS, *Dub.* See *Acidum succinicum.*

FOR. NAMES.—*Fren.* Succin; Ambre jaune.—*Ital.* Succino; Ambra gialla.—*Span.* Sucino.—*Port.* Alambre.—*Ger.* Bernstein.—*Dut.* Barnstein; Amber.—*Swed.* Bernsten.—*Dan.* Bernsteen; Rav.—*Russ.* Jantar.—*Arab.* Kernulbehr.—*Pers.* Karooba.—*Tam.* Umbir.—*Hind.* Kepoor.

AMBER was the Ἤλεκτρον of the ancient Greeks. It is briefly mentioned by Dioscorides as a resin supposed to be the produce of the black-poplar.

It is a natural production, which is thrown up by the sea in various parts of the world, such as Sicily, Northern Russia near Cape Kahin, Maryland, and the Baltic. British commerce is supplied with it chiefly from the last source, where it is obtained in the greatest quantity not far from Memel. It is in irregular masses varying from yellowish-white to yellowish-red, translucent, or transparent, without odour or taste, and rather brittle. It contains insects and fragments of vegetables imbedded in it. It becomes highly electrical when rubbed. It is believed to be a fossil resin, the produce of an extinct plant. It melts at about 540°, and at a higher temperature burns with a yellow flame. When heated in close vessels, as directed by the London and Dublin Colleges, it yields water, acetic acid, an empyreumatic fragrant oil, and a peculiar crystalline acid, the Succinic acid. Both the acid and oil were once esteemed and much used in medicine; but they are now so little employed, that it is scarcely necessary to retain them in the Pharmacopœias, or to describe them minutely here.

The oil is a local irritant, and internally a stimulant and antispasmodic in the dose of five or ten minims. The acid has been supposed, like the benzoic acid, to be an expectorant, but probably with as little reason.

SULPHUR, *E. L. D.* *Sulphur.*

TESTS, *Edin.* It is entirely sublimed by heat, and distilled water agitated with it does not affect litmus-paper. When nitric acid is heated with it, the solution diluted with water, neutralized with carbonate of soda and acidulated with muriatic acid, does not give a yellow precipitate with sulphuretted hydrogen.

Tests, *Lond.* Sublimed sulphur is entirely sublimed by heat; and water agitated with it does not affect litmus.

SULPHUR SUBLIMATUM, E.

Process, *Edin.* Sublime sulphur in a proper vessel; wash the powder thus obtained with boiling water in successive portions till the water ceases to have an acid taste; then dry the sulphur with a gentle heat.

UNGUENTUM SULPHURIS, E. L. D.

Process, *Edin. Dub.* Take of
Sulphur, one ounce (pound, D.)
Axunge, four ounces (pounds, D.)
Mix them well together.

Process, *Lond.* Take of
Sulphur, three ounces;
Lard, half a pound;
Oil of bergamot, twenty minims.
Mix them.

UNGUENTUM SULPHURIS COMPOSITUM, L.

Process, *Lond.* Take of
Sulphur, half a pound;
Veratrum bruised, two ounces;
Nitrate of potash, a drachm;
Soft soap, half a pound;
Lard, a pound and a-half;
Oil of bergamot, thirty minims.
Mix them.

For. Names.—*Fren.* Soufre.—*Ital.* Zolfo.—*Span.* Azufre.—*Port.* Enxofre.—*Ger.* Schwefel.—*Dut.* Zwavel.—*Swed.* Swafwel.—*Dan.* Svovl.—*Russ.* Seva.—*Arab.* Kabril.—*Pers.* Gowgird.—*Tam.* Gendagum.—*Beng.* Gunduc.—*Hind.* Gundhuc.

Sulphur is an abundant natural production in some volcanic countries, especially in Sicily; where it forms great beds in the bituminous marl and clay-slate, in valleys of the secondary or transition formation. It especially abounds near Girgenti; where the ground can scarcely be dug deeply without its being found. It occurs also in small quantity in some vegetable and also in many animal substances. It likewise abounds in nature in the combined state, forming metallic sulphurets.

Natural History.—It is obtained from two sources for supplying the wants of medicine and the arts. What is generally used in Britain is imported from Sicily and is known as Volcanic sulphur. This kind occurs massive and crystallized. The crystallized variety presents the form of very acute rhombic octaëdres, bright sulphur-yellow in colour, and exceedingly pure. The massive variety, which constitutes the greater part of the imported article of British commerce, has a grayish-yellow tint, rather less brittleness, and less lustre; and it presents many grayish or bluish spots and streaks, arising from mineral impurities. From volcanic sulphur pure sulphur is prepared in this country by distillation, as directed by the Edinburgh Pharmacopœia. Two kinds are thus made, Roll-sulphur and Flowers of sulphur, or Sublimed sulphur. Both however undergo the process of sublimation. Roll-sulphur, which was formerly prepared by simply fusing the crude substance and running it into moulds, is now made (Pereira) by subliming it in iron vessels and fusing the product. Flowers of sulphur are prepared by passing the sublimed vapour into a close chamber of considerable size, in which it is condensed in fine impalpable powder. The powder consists of minute globules between a thirtieth and a two-hundredth of an inch in diameter, unless they have been

exposed to light or agitation, when they are apt to present a crystalline structure. In this state sulphur contains at first a little sulphuric acid, because some of it undergoes combustion in the act of subliming. But this impurity is easily removed by washing it in boiling water.—A considerable part of the sulphur used on the continent is prepared, not as in Britain, from the volcanic variety, but from copper and iron pyrites, especially the latter, and is called Pyritic sulphur. Pyritic sulphur is never used in Britain unless when the commercial relations of the country with Sicily happen to be disturbed. It is prepared at Dylta in Sweden, as well as in various parts of Germany, from iron pyrites, the bisulphuret of iron, by simply heating this mineral in close vessels; for at a strong red heat one equivalent of sulphur is given off. At Fahlun in Sweden a particular contrivance is adopted, by which, after the equivalent of sulphur is disengaged, the residual sulphuret supplies heat by its combustion for keeping up the process of distillation (Berzelius). Pyritic sulphur is usually purified by fusion or a second distillation.

Chemical History.—The sulphur of the shops, whether in rolls or in fine powder, has a bright yellow colour, and a faint peculiar odour and taste. Roll-sulphur is exceedingly brittle, and developes much electricity when rubbed. Both varieties, when heated to between 224° and 230°, pass into a state of fusion; about 400° or a little higher the melted mass becomes thicker and brownish; and if either kept for some time at this temperature, or suddenly cooled by being poured into cold water, it continues for a short while afterwards soft, tough, and capable of receiving and retaining delicate impressions of coins, seals, and the like. At 650° it sublimes unchanged, if oxygen be excluded. About the same temperature it takes fire if in contact with air, burns with a lambent blue flame, and produces highly suffocating vapours of sulphurous acid gas. Sulphur is insoluble in water, but soluble in alcohol, sulphuric æther, and the oils, both fixed and volatile.—Another form of sulphur, till lately officinal, but now excluded from the British Pharmacopœias, is Precipitated sulphur, obtained by decomposing a solution of sulphuret of potassium or lime by means of a strong acid. In this state it has a pale grayish-white colour, and contains some adhering water; but in other respects it is identical with flowers of sulphur.

Adulterations.—Sulphur, as met with in the shops of this country, is little subject to adulteration. It ought to be entirely free of any fixed impurities; which is ascertained by subliming it. It should also be free of sulphuric acid, which is apt to be present from insufficient care in subliming or subsequently washing it; and which may be discovered by agitating the sulphur with distilled water, and testing the water with litmus, as the Pharmacopœias direct. The London College has not adverted to the occasional presence of arsenic, because this adulteration is believed never to occur in volcanic sulphur, the only variety usually met with in

Britain. It is so important an adulteration in reference to delicate medico-legal inquiries in cases of poisoning with arsenic, that the possibility of arsenic being indicated from this source ought not to be lost sight of. Arsenic is best detected according to the Edinburgh formula, by converting the sulphur and arsenic into sulphuric and arsenic acids through the action of nitric acid and heat, neutralizing the acids by carbonate of soda, adding muriatic acid in excess, and transmitting sulphuretted-hydrogen for some minutes; upon which yellow sulphuret of arsenic will fall down. Arsenic may be detected in sulphuric acid made from pyritic sulphur by diluting it with water and transmitting sulphuretted-hydrogen gas (see *Acidum sulphuricum*).

Actions and Uses.—Sulphur is a stimulant, laxative, and diaphoretic, and in regard to one disease, scabies, it is considered a specific. The product of its combustion, sulphurous acid, which is used externally as a remedy, though not contained in the Pharmacopœias, is a powerful irritant to the lungs, and when applied to the skin, an alterative stimulant.

Sulphur does not possess any marked properties as a stimulant of the general circulation or nervous system. Its laxative virtues depend on its possessing a local stimulant action. It is an effectual yet mild laxative, probably indeed one of the mildest of all cathartics; and hence it has at different times been much used in hæmorrhoids, diseases of the bladder, and pregnancy, both alone, and combined with bitartrate of potash or other saline purgatives. It is unfortunately open to the serious objection, that it renders the stools, and even the insensible transpiration, insupportably fetid; which arises from its being converted within the body into sulphuretted-hydrogen. It is given as a laxative alone, in the dose of one to three drachms, with milk, or in the form of electuary. When prescribed with bitartrate of potash, thirty grains of sulphur and two drachms of salt will be often sufficient.—A stimulant effect upon the secreting vessels of the skin has been generally conceded to sulphur, and is the foundation of its employment in chronic catarrh, chronic rheumatism, the chronic stage of hooping-cough, and in cutaneous diseases at large. Its powers as a diaphoretic however have never been proved to be great, and have been probably inferred, less from actual observation of increased diaphoresis under its use, than from the circumstance that the sulphur passes off in part through the skin. Of this there can be no doubt, both from the odour of the cutaneous secretion, and from the blackening of silver coins or ornaments which happen to be kept about the person. As a diaphoretic, it is administered in repeated doses of twenty or thirty grains in milk, weak syrup, or aromatized mucilage.—The emmenagogue virtues recognized by some in sulphur are of very doubtful existence.—Among its actions as an internal remedy may be enumerated its specific influence in scabies; but its power in that disease is much greater when it is applied outwardly.

The most important of its external applications is as a specific in scabies. Its action here is not well understood. Scabies arises from a specific virus, and is cured almost invariably by the direct application of sulphur to the diseased parts. Hence sulphur seems to be an antidote to the poison of scabies. An attempt has been made to show that the action is nothing more than a poisonous influence exerted upon the little insect (*Acarus scabiei*) which has been lately discovered in the pustules and vesicles of this eruptive disease. But since the insect appears to be by no means always present in the diseased parts, and nevertheless the characters of the disease are essentially the same, whether the insect be present or not,—there arises a doubt whether this much-talked-of creature is the cause of the disease or merely an incidental visitor during its course. As a remedy for scabies, sulphur is generally used in the form of ointment. This mode of treatment is objectionable on account of its filthiness, and hence frequent attempts have been made to discover a substitute. The only one of these which has hitherto stood the test of experience is chloride of lime; and if my own observation of its effects may be trusted, it is not inferior in certainty to sulphur. I have only once been unsuccessful with it. A compound sulphur ointment containing white-hellebore root has been adopted by the London College; but, though more irritating, its supposed superiority to the simple ointment, as a specific for scabies is problematical.——Sulphur-ointment is also sometimes used in various other cutaneous diseases, of the vesicular, scaly, or papular kind; but in them its virtues are much less energetic than in scabies.

In a great variety of diseases of the skin sulphur is a valuable remedy, when converted by combustion into sulphurous acid, and applied in the form of an air-bath or vapour-bath. Baths of this description have been long more or less known in medical practice. But they have come into general use only since 1812, when the proper construction of baths was fixed by M. D'Arcet, and extensive experiments were made in Paris by M. Galés upon their employment in a great variety of chronic diseases. Sulphurous acid gas, the product of the combustion of sulphur, is powerfully irritating to the glottis, altogether irrespirable even when much diluted with atmospheric air, and also most destructive to vegetation when present in the air even in minute proportions not discoverable by any of the senses. But if the head be protected, as in the apparatus of D'Arcet, the gas may be applied with perfect safety to the skin, along with air or watery vapour. The effects, partly occasioned by the heat and partly by the gas, are warmth, redness, and pricking of the integuments, followed by considerable sweating and excitement of the circulation. The diseases which have been chiefly benefited by this treatment are scrofula, chronic palsy, but especially chronic rheumatism, scabies, and all kinds of scaly cutaneous disorders.

The effects of sulphur and of sulphurous acid in cutaneous diseases and in rheumatism may be also obtained by using the sulphuret of potassium in the form of bath (see *Potassii sulphuretum*).

The preparations of sulphur and their doses are; *Sulphur*, gr. xxx. ad dr. ii. *Unguentum sulphuris*, E. L. D.; *Unguentum sulphuris compositum*, L.; for external use.

TABACUM, *E. L.* NICOTIANA TABACUM, *D.* *Leaves of Nicotiana Tabacum, L. W. Spr.* *Tobacco.*

ENEMA TABACI, E. L.

PROCESS, *Edin. Lond.* Take of
Tobacco, fifteen grains to half a drachm (one drachm, L.);
Boiling water, eight fluidounces (a pint, L.)
Infuse for half an hour (a whole hour, L.), and strain.

INFUSUM TABACI, D.

PROCESS, *Dub.* Take of
Tobacco leaves, a drachm;
Boiling water, a pint (old wine-meas.)
Digest for an hour in a covered vessel, and strain.

VINUM TABACI, E.

PROCESS, *Edin.* Take of
Tobacco, one ounce;
Sherry, twelve fluidounces.
Digest for seven days; strain, express strongly the residuum, and filter the liquors.

FOR. NAMES.—*Fren.* Tabac.—*Ital.* Tabacco; Nicoziana.—*Span.* Tabaco.—*Port.* Herva Santa.—*Ger.* Tabak.—*Dut.* Tabac.—*Swed.* and *Dan.* Tobak.—*Russ.* Tabak; Tiotion.—*Arab.* Bujjerbhang.—*Tam.* Poghei.—*Hind.* and *Beng.* Tambaka; Tumak.

FIGURES of Nicotiana Tabacum in Nees von E. 194.—Hayne, xii. 41.—Steph. and Ch. i. 37.

DOUBTS are entertained as to the period when TOBACCO first became known to civilized nations. According to some antiquarian inquirers, the Hindoos, the Persians, and the Chinese have been acquainted with it from a remote era as a medicine. But there seems strong reason to infer, that it was not used for any purpose in the Old World, and certainly not for smoking, till after the discovery of America. In Europe, at all events, it was positively not used till about the close of the fifteenth century, soon after the first return of Columbus from his discoveries (*see* Cleland's Essay on Tobacco, 1840).

Natural History.—Different species of tobacco are made use of in different countries. That chiefly used in Europe, and alone in medicine, is the *Nicotiana Tabacum*, a plant naturally inhabiting the hotter parts of North and South America, but which has been spread over every quarter of the world, and may be cultivated to advantage even in Britain. It belongs to the Linnæan class and order *Pentandria Monogynia*, and to the Natural family *Solanaceæ*. It is a herbaceous annual, towards six feet tall, with large ovate viscid leaves, dingy-red glutinous funnel-shaped flowers, and ovate bilocular capsules, full of minute kidney-shaped seeds. The officinal part is the leaf, in the form of common Tobacco. There are numberless forms and varieties of tobacco to be met with in

trade, differing greatly in flavour as well as strength, according to the country which produces it, the modifying effects of cultivation, and the mode of manufacture. The kind most esteemed by the smoker is Havannah tobacco; but the Virginian sort is the strongest. For the important object of uniformity in strength it is desirable that one kind only should be kept by the druggist; and the Virginian is in most common use. It is dark brown, somewhat clammy, of a powerful, peculiar, heavy odour, and of a strong, bitterish, nauseous taste, followed by a very peculiar, unpleasant, acrid sensation in the throat.

Chemical History.—Tobacco yields its properties readily to hot water, or to spirituous fluids. The former menstruum is employed for making the medicinal *Infusum* and *Enema tabaci;* wine is a good vehicle for giving it internally, and is adopted for the *Vinum tabaci* of the Edinburgh College; and a tincture is also employed by some, which is made with one part of tobacco and eight parts of proof-spirit.——The chemical constitution of this drug has been ably investigated by many chemists. The most important results are those of Posselt and Reimann, in 1828, The fresh leaves contain in 10,000 parts 1172 of solid matter; of which 287 are bitter extractive, 174 gum, 27 resin, 26 albumen, 105 amylaceous gluten, 133 organic and inorganic salts, 497 ligneous fibre, 6 a peculiar oily-like alkaloid called Nicotina, and 1 a camphoraceous volatile oil termed Nicotianin. Nicotianin, previously discovered by Hermbstädt, is obtained by simple distillation with water in the form of supernatant scaly crystals; which have the odour of tobacco, and its bitterish warm taste, without its acridity, and which are neutral, insoluble in water or weak acids, but soluble in alcohol, ether, and alkaline solutions. The best process for obtaining Nicotina is perhaps that of Barral, who prepared it by digesting the leaves for three days in water, acidulated with sulphuric acid, distilling the expressed liquor along with lime to one-half, removing the nicotina from the distilled fluid by agitation with ether, distilling the residual liquor again with the calcareous residuum, and again removing nicotina with ether from the distilled fluid, expelling the ether and water from the etherial solution by a heat rising gradually during fifteen days to 250° F, and finally distilling the impure nicotina from lime in an apparatus filled with hydrogen to prevent the action of atmospheric air, and heated to about 340° in an oil-bath. The product is about 8 parts from 10,000 of leaves. It is an oleaginous, colourless fluid, which belongs to the same class of principles with conia, and closely resembles it in chemical properties. It is heavier than water, and liquid at 22° F. It has an excessively pungent odour of tobacco, and an acrid, burning taste, so intense as to be imparted perceptibly to 10,000 parts of water. It evaporates at 284°, and emits white penetrating vapours of an overpowering tobacco odour. It is somewhat soluble in water, more so in alcohol and ether. It is strongly alkaline in

its reactions, neutralizes acids, and forms with them salts which are mostly crystallizable. In all states it is apt to undergo change when heated, passing to a resinoid condition, and disengaging ammonia. It is the active constituent of tobacco. It exists in various proportions in different tobaccos. MM. Henry and Boutron found 3.86 parts in a thousand of tobacco prepared for snuff and cigars, 5.28 in that from Maryland, 8.64 in Havannah tobacco, 10.0 in Virginia tobacco, and 11.28 in some specimens grown in France. Its composition is $C^{20} H^{16} N$, according to the analysis of Barral. —The empyreumatic oil of tobacco,—which, as formed in the pipe of the smoker, is well known to be an active poison,—appears from the inquiries both of Dr Morries and of Melsens, to be nicotina attached to a true volatile oil.

Actions and Uses.—Tobacco is locally a stimulant, and remotely a narcotic, sedative, emetic, laxative, diuretic, and antispasmodic. Its primary local stimulant action is exemplified in the familiar effects of its powder on the nostrils, and of its smoke on the salivary glands. In large doses internally it is a potent narcotic poison, the effects of which are of a mixed kind, indicating depression both of the cerebral functions and of the heart; and death occurs in connexion sometimes with the one, sometimes with the other action. Its infusion is more apt to affect the heart, and its smoke to act on the brain. This difference is best seen when the effects are insufficient to prove fatal; for the infusion causes great feebleness of the pulse, fluttering of the heart, excessive faintness, copious perspiration, extreme alarm, and sometimes vomiting; while the smoke seems more apt to cause sickness and vomiting, followed by drowsiness, and often by prolonged lethargy. Occasionally a transient stimulus precedes these symptoms of depression. In still lower doses it is a diuretic and occasionally also laxative; and these effects may occur independently of any action either on the brain or heart. In many individuals, who use it habitually, the smoke has an extraordinary power in removing exhaustion, listlessness, and restlessness, especially when brought on by bodily or mental fatigue; and this property is the basis of its general use as an article of luxury. There are also not a few persons however who experience no such effects from it; and many confirmed smokers and snuff-takers have no better excuse for the habit than imitation in the first instance, and the force of custom afterwards. Some imagine that the practice of smoking and snuffing is detrimental to health; but this supposition is doubtful, unless when the practice is carried to great excess.—Tobacco acts upon the body through whatever channel it is introduced.

Its special applications are numerous. It is sometimes used as a diuretic in dropsy; and Fowler was much attached to it for this purpose. I cannot say that I have been able to obtain his favourable results in my own trials. Its chief use is as an antispasmodic in strangulated hernia and other intestinal obstructions, and in re-

tention of urine from obstructions in the urethra or ureters,—in all of which circumstances it is given in the way of injection. It is in the same form a powerful sedative in acute internal inflammations, especially of the abdomen. There is no other means so effectual as the tobacco clyster in moderating reaction, evacuating the bowels, and dispelling tympanitis in advanced peritoneal inflammation. It is sometimes useful in painful urethral affections, when rubbed on the perinæum in the form of liniment, or introduced on a bougie into the canal itself. An infusion is the most certain poison for destroying vermin on the skin; but it is dangerous in the case of children. The employment of tobacco-smoke in the treatment of suspended animation is now properly exploded.

Tobacco cannot be used against intestinal obstructions or for similar purposes but with great caution, because the induction of a minor degree of its poisonous effects seems indispensable for its therapeutic operation. The dose of good tobacco for an injection ought therefore not to exceed a scruple at first. If this fail, which seldom happens, it may be gradually increased. A drachm, though often recommended, has repeatedly proved fatal, and even half a drachm has had the same effect. If the injection do not come away in five minutes, it should be assisted by throwing up a large quantity of tepid water; and if its sedative action be too great or too lasting, such stimulants as ammonia and brandy ought to be administered.

Nicotina is so energetic a poison, that half a grain has been known to kill a dog.

TAMARINDUS, *E. L.* TAMARINDI FRUCTUS, *D.* *Pulp of the pods of Tamarindus indica, L. W. DC. Spr. Tamarind-pulp.*

FOR. NAMES.—*Fren.* Tamarin.—*Ital.* Polpa di tamarindo.—*Span.* Tamarindo. *Port.* Tamarindos.—*Ger. Dut.* and *Dan.* Tamarinde.—*Swed.* Tamarind.—*Arab.* Umblie.—*Pers.* Tumiri hindee.—*Tam.* Pollium.—*Hind.* and *Beng.* Ambli.—*Hind.* Tamari hindi.

FIGURES of Tamarindus indica in Hayne, x. 41.—Nees von E. 343.—St. and Ch. ii. 88.

TAMARIND-PULP was first used in medicine by the Arabian physicians, and was brought from the East-Indies, where the plant is named in the Hindee language *Tamari hindi* or Indian-date.

Natural History.—The plant which produces it is a considerable tree, of great beauty, belonging to the Linnæan class and order *Diadelphia Triandria*, and to the Natural family *Leguminosæ*. It is met with everywhere in India, Arabia, and Egypt; and a variety of it abounds also in the West-Indian islands. It bears beautiful pinnated leaves, and elegant flowers changing gradually from snow-white to lemon-yellow. The fruit is a pod about the size of that of the garden-bean, and somewhat like it in appearance. It consists of a brittle ligneous husk, immediately enclosing

a pulpy texture, which is traversed by numerous branching ligneous fibrils, and contains one or more seeds imbedded in it. The seeds, which are brownish-red and shining, are invested each in a thin loose membrane; and they are composed of a very hard tough shell and a firm bitterish nucleus. The only officinal part is the pulp between the seeds and husk. It is usually imported along with the seeds, but stripped of the husk, and preserved in raw sugar. Sometimes however it is brought to this country in the form of the dry entire pods without any saccharine substance for their preservation.

Chemical History.—Tamarind-pulp has a pleasant, sweetish, very acid taste. It is composed, according to an old analysis by Vauquelin, of a little sugar, gum, pectic acid, and parenchymatous fibre, with 9.4 per cent of citric acid, 1.5 of tartaric acid, 0.5 of malic acid, and 3.25 of bitartrate of potash. It readily parts with its properties to water.

Adulterations.—A sophisticated article, in imitation of it, is said to be made in Europe of pulp of prunes, strawberry fibres, and bitartrate of potash or sulphuric acid. But this fraud is unknown in British trade. Genuine tamarind-pulp is likewise said to be sometimes accidentally contaminated with copper; which may be detected by drying and incinerating the pulp, acting on the ashes with diluted nitric acid at a moderate heat, and testing the solution for copper by an excess of ammonia.

Actions and Uses.—Tamarind-pulp is gently laxative and refrigerant. It is useful for making acidulous drinks in febrile diseases. It is scarcely ever employed alone as a laxative; but it forms part of the *Infusum sennæ cum tamarindis* of the Edinburgh and Dublin Pharmacopœias, and of the *Electuarium* or *Confectio sennae* of the three Colleges. A convenient cooling laxative is tamarind-whey, made by boiling an ounce of pulp in a pint of milk, and straining the product.

TANACETUM, *D.* *Leaves of Tanacetum vulgare, L. W. DC.* —*Tansy.*

For. Names.—*Fren.* Tanaisie.—*Ital.* Tanaceto.—*Span.* Yerba lombriguera; Tanaceto.—*Ger.* Rheinfarrn; Wurmkraut.—*Dut.* Reinevarr; Zekerkruid. —*Swed.* Renfana.—*Dan.* Reinfan; Ormekrud; Tandsue.—*Russ.* Pischma obiknovennaia; Rjabinka dikaia.

Figures of Tanacetum vulgare in Hayne, ii. 6.—Nees von E. 236.—Steph. and Ch. iii. 116.

Tansy, a very old article of the Materia Medica, has fallen into complete neglect except in domestic practice, and is now retained only by the Dublin College.

The plant belongs to the Linnæan class and order *Syngenesia Polygamia superflua*, and to the natural family *Compositæ* of Decandolle or *Asteraceæ* of Lindley. It abounds throughout Europe, and is common upon pastures, river-banks, and roadsides in this

country. Every part of it has a powerful, penetrating, peculiar, somewhat camphoraceous odour, and a corresponding aromatic bitter taste, which is nauseous if strong, but not unpleasant when weakened by dilution. Its bitterness is owing to a resin, and its aroma to a volatile oil, which may be obtained in the usual way by distillation with water.

Tansy is a bitter tonic and stimulant, not without efficacy in dyspepsia, especially where flatulence is troublesome. It is also a good vermifuge; for which purpose it is still sometimes employed in domestic medicine. An infusion has been used for warding off the gouty paroxysm (Duncan); and some consider it a good antispasmodic in hysteria. It is employed for seasoning puddings; but its flavour is disagreeable to many.—An ounce of the volatile oil has proved fatal (Wood and Bache).

TAPIOCA, *E.* *Fecula of the root of Janipha Manihot, Humb. et Bonpl. Nov. Gen. et Sp.* ii. *Spr.—Tapioca.*

For. Names.—The term Tapioca has been adopted in the few European countries, besides Britain, in which the substance is currently known..

Figure of Janipha Manihot in Bot. Mag. 3071.

Tapioca is mentioned by Piso in his Natural History of Brazil, but was little known in Europe till after the beginning of the present century.

Natural History.—It is an amylaceous substance obtained from the root of the *Janipha Manihot,* a plant of Linnæus' class and order *Monœcia Monadelphia,* and of the Natural family *Euphorbiaceæ.* This plant abounds in Brazil and Guiana, and is much cultivated in the West-Indian islands. It is a shrub about six feet high. There are two varieties of the plant. The root of one variety, which is fusiform, brown externally, and not above six ounces in weight, has a sweetish amylaceous taste without any bitterness; and being quite wholesome, it is in use as an article of food under the name of Sweet-Cassava. But the root of the commoner variety, called Bitter-Cassava, which is much larger, knotty, and black externally, has a bitter taste, and is a deadly narcotic poison. As this property however resides only in the juice, it may be completely removed by careful elutriation. Tapioca is prepared from the root of the Bitter-Cassava only by reducing it to a pulp, washing this with cold water in funnel-shaped mat-filters, letting the starch subside in the milky fluid which passes through, elutriating the starch in the usual manner, and finally converting it into the granular form by drying it on hot plates.

Chemical History.—Tapioca is imported into Britain chiefly from Bahia and Rio Janeiro (Pereira). It is a very pure starch, in the form of irregular warty grains, seldom larger than a pea, white, tasteless, and without odour. It consists of aggregated starch-globules, about a 2000th of an inch in diameter, according to my

observations, and very uniform in size. By the minuteness and regularity of its globules, it may be easily distinguished from most other medicinal varieties of starch (see *Maranta*); but they resemble considerably in both respects the globules of wheat-starch. Cold water partially dissolves it, forming a liquid which yields a blue precipitate with iodine; for the heat used in preparing Tapioca bursts the tegument of many of the globules, so that the contained amidin comes in immediate contact with the water. Boiling water dissolves it almost entirely, or, if in small proportion to the tapioca, forms with it a firm, translucent, tasteless jelly.

The expressed juice of the root possesses the narcotic properties of the fresh root. The source of their activity was discovered by M. Henry to be the hydrocyanic acid; a remarkable observation, which I have had an opportunity of confirming with juice from Demerara.

Various other alimentary substances are obtained from the root of the *Janipha Manihot* besides tapioca. The starch dried without heat is called in Brazil Cipipa, and is said to be sometimes imported into Europe under the name of Brazilian Arrow-root. The bruised pulp of the root, well washed, and dried in round thin cakes upon hot plates, constitutes the Cassava-bread of the West-Indies. And the filtered juice concentrated to the consistence of syrup, by which all its poisonous properties are dispelled, is used in Guiana, under the name of Casaripe, for seasoning soups and sauces.

Actions and Uses.—Tapioca is in general use in the sick-room as a light and agreeable article of nourishment. It makes a firmer jelly with boiling water than most varieties of starch, and its granular form also gives it more consistence than any other kind. No amylaceous substance is so much relished by infants about the time of weaning; and in them it is less apt to become sour during digestion than any other farinaceous food, even arrow-root not excepted.

TARAXACUM, *E. L. D.* *Root (and Herb,* D.) *of Taraxacum Dens-leonis, Desfontaines, Fl. Atlan. DC.* (Edin.)—*of Leontodon Taraxacum, Linn.* (Lond. Dub.) *Dandelion.*

DECOCTUM TARAXACI, E. D.

PROCESS, *Edin. Dub.* Take of Dandelion, herb and root, fresh, seven (four, D.) ounces; Water, two (old wine, D.) pints. Boil down to one pint, and then squeeze and strain.

EXTRACTUM TARAXACI, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of Fresh root (and herb, D.) of dandelion, a pound; Boiling water, a gallon. Proceed as for extract of Gentian (of Poppy-heads, E.)

FOR. NAMES.—*Fren.* Pissenlit.—*Ital.* Tarassaco; Macerone.—*Span.* Diente de leon.—*Port.* Dente de leão.—*Ger.* Löwenzahan; Pfaffenröhrlein.—*Dut.* Pardebloem; Zeeuwewand.—*Swed.* Lejontand; Maskrosor.—*Dan.* Lövetand; Prästekrone.—*Russ.* Oduvantschik; Dukie taikorie.

FIGURES of Taraxacum Dens-leonis as Leontodon Taraxacum in Nees von E. 249.—Hayne, ii. 4.—St. and Ch. i. v.

The Dandelion is supposed to have been the Αφακη of Theophrastus; but the Dioscoridean plant of that name is wholly different. It has been used immemorially however in European medicine.

Natural and Chemical History.—It is the *Taraxacum Dens-leonis* or *Leontodon Taraxacum* of botanists, and belongs to the Linnæan class and order *Syngenesia Æqualis*, and to the Natural family *Compositæ* of Decandolle and *Cichoraceæ* of Lindley and others. It has a perennial spindle-shaped root, from which proceed several annual herbaceous shoots, consisting of root-leaves and a single flower on a naked peduncle. The whole plant abounds in a milky bitter juice, whose sensible qualities are said to be greatest just before inflorescence, and least very early in spring or at the close of autumn. At these latter periods indeed it is said to be sweetish and not bitter (Geiger). The juice is more bitter in the leaves and stem than in the root. It contains mannite, caoutchouc, resin, gum, inulin, various salts, and a neutral, crystalline, very bitter principle, which may be obtained in stellated and dendritic masses by receiving the fresh juice in distilled water, removing albumen and resin by ebullition, and slowly evaporating the filtered fluid (Pollex). This principle, termed Taraxacine, is probably the active ingredient, and deserves investigation as such. Water dissolves out the bitter ingredient of the root. Hence the *Decoctum taraxaci* is one of its officinal preparations. The form in most use however is the *Extractum taraxaci*, prepared from a decoction of the fresh roots, or, according to the Dublin Pharmacopœia, from the root and herb together. The roots yield from 20 to 25 per cent of extract between November and February, and from 11 to 12.5 per cent in April and May (Squire); but the extract is said to be most bitter and probably therefore most active when least abundant.

Actions and Uses—Dandelion is considered a diuretic, aperient, tonic, deobstruent, and alterative. But its virtues in all these respects have been much exaggerated. After having been long almost abandoned in practice, it was resumed not many years ago in this country, and became a fashionable remedy, especially in London, as a tonic aperient and alterative in dyspepsia, and as a deobstruent and promoter of the biliary secretion in functional as well as organic diseases of the liver. It seems not without use in dyspepsia and functional biliary derangements; but my own observation of its effects would lead me to infer, that much has been ascribed to the extract of dandelion in these and other affections, which must have been owing to collateral remedies or to regimen and diet.

The doses of its preparations are: *Decoctum taraxaci*, E. D. fl. unc. i. ad. fl.unc. ii.—*Extractum taraxaci*, gr. x. ad gr. xxx.

TEREBINTHINA CANADENSIS, *L.* BALSAMUM CANADENSE, *E. D.* *Fluid resinous exudation of Abies balsamea, Marsh, Arbor. Amer.—Canada-balsam.*

For. Names.—*Fren.* Térébenthine de Canada.—*Ital.* Trementina d'America.—*Ger.* Canadischer balsam.—*Dan.* Canadisk terpentin.

TEREBINTHINA VENETA, *E. L.* *Fluid resinous exudation of Abies* (*Pinus*, D.) *Larix, Lam. Illustr.—Venice Turpentine.*

For. Names.—*Fren.* Térébenthine de Mélèze ; Térébenthine de Venise.—*Ital.* Trementina Veneta.—*Span.* Trementina de Venecia.—*Port.* Terebinthina fina.—*Ger.* Venetianischer terpentin.—*Swed.* Wenedisk terpentin.—*Dan.* Venedisk terpentin.—*Russ.* Venetsianskie terpentin.

TEREBINTHINA VULGARIS, *L. D.* *Fluid resin of Pinus sylvestris, L. W.—Common Turpentine.*

For. Names.—*Span.* Trementina comun.—*Ger.* Gemeiner terpentin.—*Swed.* Tjöck terpentin.—*Dan.* Gemeen terpentin.—*Arab.* Ratingie roomie.—*Pers.* Zungbarie.

ABIETIS RESINA, *L.* THUS, *D.* *Resinous exudation of Pinus Abies, L. W.—Frankincense.*

Emplastrum Thuris, D. See *Ferri Oxydum rubrum.*

PIX BURGUNDICA, *E. D.* PIX ABIETINA, *L.* *Concrete resinous exudation, probably in a great measure from Abies excelsa, Lam. in Enc. Méth.* vi. 518 (Edin.)—*Prepared resin of Pinus Abies, L. W.* (Lond. Dub.)—*Burgundy-pitch.*

Emplastrum Picis, E. L.

Process, *Edin. Lond.* Take of
Burgundy-pitch, one pound and a half (two pounds, L.) ;
(Frankincense, a pound, L.) ;
Resin, and
Bees'-wax, of each two (four, L.) ounces ;
Oil of mace, one (half, E.) ounce ;
Olive-oil, and
Water, of each one fluidounce (two fluidounces, L.)

Melt the pitch, resin, and wax with a gentle heat ; add the (frankincense, and then the, L.) other articles ; mix them well together, and boil till the mixture acquires the right consistence.

For. Names.—*Fren.* Poix naturelle ; Poix Blanche ; Poix de Bourgogne.—*Ital.* Pece Bianca.—*Span.* Pez de Borgona.—*Port.* Pez de Borgonha.—*Ger.* Burgundisches pech ; Weihrauch.

RESINA, *E. L. D.* *Residue of the distillation of the turpentines from various species of Pinus, L. W. Spr. and Abies, Lam. Enc. Méth.* (Edin.)—*Residue of the liquid resin of Pinus sylvestris, L. W. after the distillation of oil of turpentine* (Lond)—*Resin of Pinus sylvestris, L. W.* (*Dub.*)—*Resin.*

Ceratum Resinae, L.

Process, *Lond.* Take
Resin, and
Wax, of each a pound ;
Olive-oil, sixteen fluidounces.

Melt the resin and wax together with a gentle heat ; add the oil ; and squeeze the mixture while hot through linen.

Unguentum Resinosum, E. Unguentum Resinae, D.

Process, *Edin. Dub.* Take of
Resin, five ounces (two pounds, D.) ;
Axunge, eight ounces, (four pounds, D.) ;
Bees'-wax, two (twelve, D.) ounces.

Melt them together with a gentle heat, and then stir the mixture briskly while it cools and concretes. (Pass it through a sieve while it is hot, D.)

EMPLASTRUM RESINOSUM, E. EMPLASTRUM RESINÆ, L.
EMPLASTRUM LITHARGYRI CUM RESINA, D.

PROCESS, *Edin.* Take of
Litharge-plaster, five ounces;
Resin, an ounce.
Melt them with a gentle heat, and stir well till the mixture concretes on cooling.
PROCESS, *Lond. Dub.* Take of
Litharge-plaster, three pounds (and a-half, D.);
Resin, half a pound.
Melt the litharge with a gentle heat, add the resin in very fine powder and make a plaster.

FOR. NAMES.—*Fren* Résine jaune.—*Ital.* Resina gialla.—*Span.* Resina di pino.—*Ger.* Gemeiner harz.

TEREBINTHINÆ OLEUM, *E. L. D.* *Volatile oil of the liquid resinous exudation of various species of Pinus, L. W. Spr. and Abies, Lam. in Enc. Méth.* (Edin.)—*The oil distilled from the liquid resin of Pinus sylvestris, L. W.* (Lond. Dub.) *Oil of turpentine.*

PROCESS, *Dub.* Take of
Common turpentine, five pounds;
Water, four (old wine) pints.
Distil the oil from a copper alembic. Yellow resin will remain after the distillation.

OLEUM TEREBINTHINÆ PURIFICATUM, E. L. D.

PROCESS, *Edin. Lond. Dub.* Take of
Oil of Turpentine, a pint, (two pints, D;)
Water, four pints.
Distil cautiously so long as oil passes over with the water, till a pint and a-half of oil be obtained, D.)

ENEMA TEREBINTHINÆ, E. L. D.

PROCESS *Edin. Lond. Dub.* Take of
Oil of turpentine, one fluidounce (half an ounce, D.);
Yolk of Egg, a sufficiency (one yolk, D.);
Water, nineteen (ten, D.) fluidounces.
Rub the oil and the yolk carefully together, and then add the water gradually (at a temperature not above 100°.)

LINIMENTUM TEREBINTHINÆ, E. L. D.

PROCESS, *Edin. Dub.* Take of
Oil of Turpentine, five fluidounces (half-a pound, D.);
Resinous ointment, four ounces (a pound, D.);
(Camphor, half an ounce, E.)
Melt the ointment, and gradually mix with it the oil (and Camphor, E.), till a uniform liniment be formed.
PROCESS, *Lond.* Take of
Soft soap, two ounces;
Camphor, an ounce;
Oil of turpentine, sixteen fluidounces.
Mix them together by shaking.

FOR. NAMES.—*Fren.* Huile de terebinthine.—*Ital.* Olio etereo di trementina.—*Ger.* Terpentinöl.

PIX ARIDA, *E.* PIX NIGRA, *L.* *Pitch: from various species of Pinus, L. W. Spr. and Abies. Lam. in Enc. Méth.* (Edin.)—*Solid prepared resin* (Lond.)—*Pitch.*

UNGUENTUM PICIS NIGRÆ, L.

PROCESS, *Lond.* Take of
Pitch, Wax, and
Resin, of each nine ounces;
Olive-oil, sixteen fluidounces.
Melt them together, and then squeeze through linen.

FOR. NAMES.—*Fren.* Poix noire.—*Ital.* Pece nera.—*Span.* Pez negra.—*Ger.* Schiff pech.—*Russ.* Var.

PIX LIQUIDA, *E. L. D.* *Tar; from various species of Pinus, L. W. Spr. and Abies, Lam. in Enc. Méth.* (Edin.)—*from various species of Pinus, Willd.* (Dub.)—*Prepared liquid resin from Pinus sylvestris* (Lond.)

UNGUENTUM PICIS LIQUIDÆ.

PROCESS, *Edin.* Take of
Tar, five ounces;
Bees'-wax, two ounces.
Melt the wax with a gentle heat, add the tar, and stir the mixture briskly as it concretes on cooling.

PROCESS, *Lond. Dub.* Take of
Tar, and Suet, of each one pound.
Melt them together, and squeeze through linen.

AQUA PICIS LIQUIDAE, D.

PROCESS, *Dub.* Take of
Tar, two (old) pints;
Water, a gallon.
Mix and stir with a wooden rod for fifteen minutes; then, when the tar has subsided, filter the liquid, and keep it in well-closed jars.

FOR. NAMES.—*Fren.* Goudron.—*Ital.* Catrame.—*Ger.* Theer.—*Swed.* Tjära.—*Russ.* Degot.

FIGURES of Pinus sylvestris in Eng. Bot. 2460.—Lambert, Pin. 1.—Nees von E. 80.—St. and Ch. ii. 73.—Pinus maritima as Pinus Pinaster in Lambert, 4 and 5.—Nees von E. 76, 77.—Abies picea in Lambert, 30.—Abies excelsa as Pinus Abies in Nees von E. 81.—St. and Ch. ii. 75.—Abies balsamea as Pinus balsamea in Lambert, 41.—Nees von E. 82.—St. and Ch. ii. 74.—Abies Larix as Pinus Larix in Lambert, 35.—Nees von E. 84.

THE officinal substances derived from the Pine or Fir tribe of plants are so numerous, and bear so intricate a relation to one another, that their sources, properties, and nature cannot be well understood unless they be regarded in one connected view. On this account they are here brought together under a single head. The subject is naturally complex; but much has been lately done to reduce it to order by M. Guibourt in France, and by Dr Pereira in this country.

Natural History.—It will be seen from the references to the British Pharmacopœias at the head of this article, that the London College has acknowledged only three officinal pines, the *Pinus silvestris*, *Pinus Abies*, and *Abies balsamea.* But this is a mistaken view of the subject. For in reality the sources of the officinal products of the pines are numerous; so that the Edinburgh College has perhaps acted most prudently in giving the greater part of the botanical references in general terms. The officinal plants all belong to the Natural family *Coniferæ* of Decandolle or *Pinaceæ* of Lindley, and to the Linnæan class and order *Monœcia Monadelphia.* They are all included in Linnæus's single genus *Pinus*, and now in those of *Pinus, Abies*, and *Larix*, into which that genus has been since subdivided. The species which have been ascertained to furnish more or less of those commercial articles which have been admitted into the Pharmacopœias are, 1. *Pinus sylvestris* of Linnæus and all succeeding botanists, the Scotch fir;—2. *Pinus maritima* of Lamarck and of Decandolle, or *P. Pinaster* of Aiton and of Lambert, the Bordeaux-pine, or Pine of the Landes;—3. *Pinus palustris* of Lambert, or *P. australis* of Marsh, the Mississipi-pine, or Swamp-pine;—4. *Abies picea* of Lindley, *Abies pectinata* of Decandolle, or *Pinus picea* of Linnæus and Lambert, the Silver-fir of Germany, Switzerland, and Siberia;—5. *Abies excelsa* of Lamarck and of Decandolle, or *Pinus abies* of Linnæus and of

Lambert, the Norway Spruce-fir;—6. *Abies balsamea* of Marsh and of Lindley, or *Pinus balsamea* of Linnæus and of Lambert, the Balm-of-Gilead fir of North America;—and 7. *Abies Larix* of Lamarck, *Pinus Larix* of Linnæus and of Lambert, or *Larix europæa* of Decandolle, the Larch, originally a native of the German and Swiss Alps, as well as of Siberia. The native countries of these magnificent ornaments of the forests of the old and new worlds will be apparent from the terms of this brief enumeration of them. Most of them are cultivated in Britain.

Many other pines besides these yield articles which are more or less known in commerce, and which are also probably applied to medical use; but they have not been so distinctly traced to be officinal species, so far as regards medical practice in this country. These are, 8. *Pinus Tæda* of Lambert, the Frankincense-pine of Virginia;—9. *Pinus Pumilio* of Willdenow, the Mountain-pine of Hungary;—10. *Pinus Cembra* of Linnæus, the Siberian Stone-pine of the Alps and Carpathian mountains;—11. *Abies Canadensis* of Lindley, the Hemlock Spruce-fir of North America;—12. *Abies nigra* of Michaux, the black Spruce-fir of the United States;—13. *Thuya articulata* of Desfontaines, or *Callitris quadrivalvis* of Richard, the Arar-tree, or Morocco Arbor-vitæ;—and 14. *Agathis* (*Pinus*, Lamb.) *Dammara* of Salisbury, the Dammara-pine of Amboyna. And it is certain that even this long catalogue does not by any means exhaust the list of productive species.

The officinal and commercial products of the plants now mentioned are obtained in part by exudation, either spontaneously or from incisions,—and partly with the aid of heat, applied either to these exudations, or to the plants themselves. In the former way are obtained numberless varieties of turpentines and resins,—in the latter way rosin, oil of turpentine, tar, pitch, and essence of spruce. Almost every species of the family pours out a kind of turpentine from natural cracks in the bark, or from express incisions; and this turpentine, which consists essentially of resin and volatile oil, passes in most of them to a firm resin in the course of time, by reason of the volatile oil being partly evaporated and partly rendered concrete through gradual oxidation. The turpentines of this family do not in general solidify easily. But two remarkable examples occur in the Dammara-resin, one of the hardest of all resinous substances, which is formed on the Dammara-pine of Amboyna (14), and in the more familiar Sandarach or Pounce, the produce of the Morocco arbor-vitæ (13). And two other instances of the same kind, though softer and more fusible, are Frankincense, an officinal resin, produced spontaneously by the Norway spruce-fir (5), and Galipot, the impure concrete resin of the pine of the Landes (2), formed on its bark late in the season, after the collection of turpentine from it has been brought to a close. Of the turpentines some are obtained, it is said, spontaneously,—such as Hungary-balsam from the points of the young twigs of the mountain-

pine of Hungary (9), and Carpathian-balsam in the same way from the stone-pine of the Carpathian mountains (10),—or by tapping vesicles which form on or beneath the bark, such as Strasburg-turpentine and true Venice-turpentine from the silver fir (4), and Canada-balsam from the Balm-of-Gilead fir (6), as well as probably from the hemlock-spruce (11). Other turpentines are got either by boring the trees, and leading the resinous juice into barrels along little wooden conduits thrust into the apertures; or by making incisions into the trunks, and collecting the juice in hollows made in the wood lower down or round the bottom of the trees. In this manner are obtained common Venice-turpentine from the larch (7),—Bordeaux-turpentine from the pine of the Landes (2),—American or Boston turpentine from the swamp-pine (3), and probably too from the frankincense pine (8),—and common turpentine from the Scotch fir (1.) Of the products of the pine tribe obtained with the aid of heat, some, such as Tar and Pitch, are very composite substances, the result of the exposure of the wood of various species to a temperature sufficient to cause its decomposition. Others, such as Essence of spruce, familiarly used for making spruce-beer, are got by exhausting the leaves of the Scotch-fir (1), black-spruce (12), or other species, by ebullition with water. And others again, such as Oil of turpentine and Resin, are produced by subjecting various turpentines to distillation with, or without, water; by which means their two leading constituents, resin and volatile oil, are detached from one another.

Among these numerous products the following have been admitted into the Pharmacopœias of the British Colleges; namely, Frankincense, with a modification of it called Burgundy-pitch, Common turpentine, Venice-turpentine, Canada-balsam, Resin, Oil of Turpentine, Tar, and Pitch.

Frankincense (*Abietes resina*, L., *Thus*, D.) is obtained in the form of concrete tears from the *Abies excelsa* of Decandolle, or Norway Spruce-fir, spontaneously or by incisions (Guibourt). It is firm and brittle, yet slowly takes the form of the vessel which contains it. At the temperature of the body it softens sufficiently to adhere firmly to the skin, and it melts easily. It has a yellowish colour externally, a paler tint within, considerable opacity, a bitterish acrid taste, but not much odour. It has not been examined chemically with care, but contains obviously much resin and a little volatile oil. It is not much used in Britain without having undergone a process of preparation, by which it is converted into Burgundy-pitch. It ought to constitute part of the London *Emplastrum picis* or Burgundy-pitch plaster, and of the Dublin *Emplastrum thuris* or Strengthening-plaster; in the latter of which it is associated with sesquioxide of iron, and is thus thought to acquire strengthening properties as an outward application. It ought likewise to enter into the composition of the *Emplastrum galbani*, L., *Emplastrum opii*, L., and *Emplastrum aromaticum*, D. When

simply melted and squeezed through a cloth, it constitutes Burgundy-pitch.

Burgundy-pitch (*Pix Burgundica*, E. D. *Pix abietina*, L.) is a term applied to more varieties than one of the products of the pines. When obtained from frankincense by fusion and expression, it does not differ from that substance in any other respect, besides being free of mechanical impurities, and having rather less volatile oil. By some pharmacologists therefore this kind of it is not distinguished at all from frankincense (Guibourt); and the Edinburgh Pharmacopœia follows their authority. A species of Burgundy-pitch is said to be similarly obtained from the silver-fir or *Abies picea*; a little turpentine being sometimes melted with it, if it be too hard (Tingry). But Guibourt denies that any Burgundy-pitch is derived from this source; and from late inquiries concludes that the only true Burgundy-pitch is obtained from the Norway-spruce (5), by allowing the turpentine, which flows from incisions, to harden on the bark, and then purifying it by melting it in water and passing it through a cloth. Dr Pereira observes, that true Burgundy-pitch is seldom to be found in the shops of this country; and that the article used as such is either prepared from old concrete American turpentine, or made with resin rendered opaque by incorporation with water, and yellow with palm-oil. The latter sort is sometimes manufactured in this city, but without the oil. Another spurious sort is made, according to Guibourt, with pitch, resin, turpentine, and water; the last of which is necessary for turning the compound from brown to yellow. Most of the spurious sorts may be known by their different odour, their bright-yellow colour, their numerous vesicles, and by the watery vapour they yield when heated. The true kind, according to Guibourt, is known by its strong, peculiar, balsamic odour, its sweet perfumed taste without bitterness, and its superior tenacity. Burgundy-pitch constitutes the chief ingredient of the *Emplastrum picis*, E. L. the pitch-plaster, or warm plaster, which is employed as a rubefacient; and it is also sometimes used alone for the same purpose. A more active substitute is now often made in this city with soap-plaster, adhesive-plaster, and cantharides, or, according to the Dublin formula for the *Emplastrum calefaciens*, with Burgundy-pitch and cantharides-plaster. This substance also forms a part of the *Emplastrum opii*, E. D., and *Unguentum resinæ albæ*, D., and of the Edinburgh *Emplastrum cantharidis compositum*.

Turpentine (*Terebinthina*, E. L. D.) differs fundamentally from frankincense only in so far as it contains more volatile oil, and is consequently more or less liquid at ordinary temperatures. There are many kinds of it, some of which are derived from other natural families besides the coniferous plants; but in the present place the pine-turpentines will be alone described. These differ from one another chiefly in fluidity, in colour, in the quickness with which they concrete, in having a more or less agreeable terebinthine odour, and in possessing a more or less bitter and acrid taste.

Three varieties have a place in the British Pharmacopœias,—Common turpentine, Venice turpentine, and Canada balsam.

COMMON TURPENTINE (*Terebinthina vulgaris*, L. D.) used to be imported chiefly from the north of Europe, as produced by the Scotch-fir, or *Pinus sylvestris*, and also from Bordeaux, as obtained from the pine of the Landes or *Pinus maritima*. But what is now known by that name comes in a great measure from the United-States, and is produced by the *Pinus palustris* or Swamp-pine, and probably too by the frankincense-pine or *Pinus Tæda*. The American variety, called sometimes *American* or *Boston turpentine*, is a thick viscid fluid or soft solid, opaque or somewhat translucent, of a pale dirty-grayish-yellow colour, acrid and bitter to the taste, and of an unpleasant, sweetish, feebly terebinthine odour. It yields seventeen per cent of volatile oil when fresh; but it soon thickens and solidifies, and gradually contains less and less oil. The Bordeaux variety, known in trade by the name of *Bordeaux Turpentine*, is obtained by exudation from incisions made with a hatchet, and is first collected in a hollow at the bottom of each tree. It is then filtered, either slowly with the aid of the heat of the sun's rays, or more quickly by melting it in a pot and passing it through a layer of straw. It is a thick turbid fluid, granular in consistence, yellowish-white in colour, of a disagreeable odour, and of a bitter, acrid, nauseous taste. It deposits a crystalline resinous sediment on standing some time; a thin layer of it solidifies in four and twenty hours; and when mixed with a 32d part of its weight of calcined magnesia it becomes in a few days firm and brittle (Guibourt). It yields when fresh about twenty per cent of volatile oil.

VENICE TURPENTINE (*Terebinthina Veneta*, E. D.) is now scarcely ever found genuine in British trade, and is seldom seen even in French commerce. The London College has therefore, not without reason, omitted it in the list of officinal turpentines. Matthioli in the middle of the sixteenth century stated, that it is obtained from the *Abies pectinata* or Silver-fir; and this statement, long lost sight of, has been recently confirmed by Guibourt, who found that it was to be obtained from this species, not by a flow from incisions, but by opening little vesicles under the bark. It is in this condition very liquid, transparent and colourless when filtered, like Canada-balsam, of a sweet citron odour, and a moderately bitter taste. A hard pellicle soon forms on exposure to the air, and a thin layer quickly becomes a firm resin. A sixteenth of magnesia speedily renders it solid. It is very seldom seen in trade, and probably never in Britain. What is generally met with on the continent as Venice turpentine is Strasburg turpentine, prepared in Switzerland from the larch by boring it deeply with an auger. This is darker, more opake, and much less liquid, far more bitter, rather acrid, and of a less agreeable odour. It hardens much more slowly, and it is not rendered solid by magnesia. The substance sold in Britain as Venice Turpentine is seldom anything else than a mixture of oil of turpentine and common

resin. All recent descriptions of Venice turpentine, prior to that of Guibourt, are erroneous.

CANADA-BALSAM (*Terebinthina canadensis*, L. *Balsamum canadense*, E. D.) is one of the finest of the pine turpentines. It is produced in North America by the *Abies balsamea*, or balm-of-Gilead fir, and probably also by the *Abies canadensis* or hemlock-spruce. It is collected sometimes by bursting little bladders on the bark, and sometimes by making deep incisions. The former sort, which is the finer of the two, is occasionally sold as true Balm of Gilead. Both sorts are fluid, transparent or nearly so, colourless or of the palest yellow tint, of a strong, agreeable, terebinthine odour, of a slightly bitter, and not very acrid taste, and very slow to consolidate. On the continent Canada-balsam is little known, and true Venice-turpentine, from the silver-fir, or the finer qualities of Strasburg-turpentine from the larch, are generally substituted for it. The former closely resembles Canada-balsam; the latter is darker and more acrid.

Chemical History.—The chemical properties and composition of several of the turpentines have been investigated by various experimentalists; but a systematic inquiry into the whole subject is still wanted. They gradually become concrete, especially if exposed to the air. This change depends partly on the escape of volatile oil, and partly on its conversion into resin. They become completely liquid at a moderate elevation of temperature. At a higher heat they give off volatile oil; and resin remains, but somewhat empyreumatised. The same decomposition takes place when they are boiled with water: volatile oil passes off with the watery vapour, an insoluble resin remains behind, which in this case is free of empyreuma, and the remaining unevaporated water holds in solution a little succinic acid. They readily take fire when flame is brought in contact with them, and they burn with a dense reddish flame and much black smoke. They are partially soluble in alcohol. Solution of potash dissolves a part of their resin and forms with it a soluble soap, while another resin and the greater part of the volatile oil remain undissolved. According to Caillot, Strasburg-turpentine, the only variety which has hitherto been carefully analysed, consists of 33.5 per cent of volatile oil, 6.2 resin insoluble in alcohol, 10.8 of a crystallizable resin termed Abietin, soluble in alcohol and incapable of being saponified, 46.4 of a resinous acid called Abietic acid, which is soluble in alcohol and unites with bases to form soaps, and about 0.9 of succinic acid. Blanchet and Sell obtained from the Alsace variety of the same turpentine 33.5 per cent of oil, 63.5 of resinous matters, and 0.9 of impure succinic acid.

The turpentines were at one time used in medicine internally; and Canada-balsam is still so employed for the arrestment of chronic mucous discharges, such as dysentery, gleet, and catarrh. At

present however they are little applied to any direct therapeutic purpose, and are chiefly useful as furnishing resin and oil of turpentine. Common turpentine forms part of the Dublin *Emplastrum ammoniaci cum hydrargyro.*

Resin (*Resina*, E. L. D.) is in chemical language a generic term, comprising a great variety of vegetable products of allied properties. But in pharmacy it is specially applied to the substance left by the pine-turpentines after removal of their volatile oil. When they are distilled with water, their oil passes over along with watery vapour; and if the process be continued till the water is all expelled, or if it be carried on without water at all, a translucent, brownish-yellow, somewhat empyreumatized matter remains, which is called Colophony, Black-rosin, or Fiddler's-rosin. But if the residuum, instead of being allowed to become dry, be freed of the last portions of oil by supplying water from time to time as its volume is reduced by evaporation, an opaque yellow substance is left, which is called Yellow-rosin. And when this is agitated with boiling water, and afterwards kept in a state of fusion at a regulated temperature, so as to expel adhering water without occasioning empyreuma, a pale, wine-yellow, translucent or transparent substance is obtained on cooling, which is the resin of pharmacy. Resin is erroneously stated by the English and Irish Colleges to be prepared from the turpentine of the Scotch fir. It is manufactured, as the Edinburgh Pharmacopœia indicates, from various kinds; and at the present moment is prepared in Britain (Pereira) chiefly from American and sometimes from Bordeaux turpentine.

Resin is translucent or often transparent, yellowish, brittle and pulverizable, rather heavier than water, of a feeble terebinthine odour and taste, fusible at a moderate heat, inflammable, soluble in ether and many volatile oils, insoluble in water, partially soluble in boiling rectified-spirit, and capable of uniting by fusion with wax, fixed oils, fats, and spermaceti. The concentrated acids dissolve it, especially with the aid of heat; sulphuric or nitric acid slowly converts it chiefly into artificial tannin; but nitric acid also produces a peculiar organic acid of interesting chemical properties, called Terebinthic acid by its discoverer, Bromeis. Solutions of potash and soda dissolve it in a great measure, but not entirely,—forming soluble soaps, and leaving a resinous principle undissolved. Resin is not a simple proximate principle, as was till lately supposed, but consists of several principles. These differ somewhat according to the degree of heat used in preparing it. When made carefully with a low and well-regulated heat, it consists in part of a neutral resinous principle, incapable of making a soap with alkalies, but chiefly of a resinous matter called Silvic acid, which unites with potash or soda to form soaps. This may be obtained apart by digesting powdered resin with cold spirit of the density 870, and then dissolving the residuum in two parts of boiling spirit of the same

strength; from which the acid crystallizes in colourless quadrangular needles as the solution cools. But if the resin had been prepared with a stronger heat, a different resinous principle is formed, called Pinic acid; which is distinguished from the former by being bitterish to the taste, and uncrystallizable. And when a still greater degree of heat had been used, and the resin is in consequence somewhat empyreumatized, so as to form colophony, a third principle is produced, called Colophonic acid; which differs from the two others in being sparingly soluble in alcohol and of a brown colour. These views on the composition of pine-resin are the result of the elaborate investigations of Unverdorben. The resin of the shops usually consists of pinic acid, silvic acid, and a neutral resin, with sometimes a little colophonic acid, to which it owes its brownish tint.

Resin is now used in medicine only as an external agent, partly on account of its own stimulant properties, but chiefly to give due consistence or adhesiveness to various ointments, cerates, liniments, and plasters. It forms a material proportion of the *Ceratum*, L., or *Unguentum resinæ*, D., *Ung. resinosum*, E. the Basilicon-ointment, a familiar stimulating application for indolent sores; and it constitutes an essential part of the Adhesive-plaster, the *Emplastrum resinæ*, E. L., or *Emplastrum lithargyri cum resinæ*, D., which, in addition to other ordinary uses in the dressing of wounds and sores, has been for some time employed with great advantage in the form of straps for giving support to the limb in cases of chronic ulcers. Resin is also contained in the *Linimentum Terebinthinæ*, E. D.; *Emplastrum picis*, E. L.; *Emplastrum simplex*, E., or *Emplastrum ceræ*, L.; *Emplastrum cantharidis*, E. L. D.; *Emplastrum belladonnæ*, E.; *Emplastrum ferri*, E.; *Emplastrum hydrargyri*, E.; *Emplastrum saponis compositum*, D.; *Unguentum æruginis*, E.; or *Unguentum cupri subacetatis*, D.; *Unguentum cantharidis*, E. L. D.; *Unguentum infusi cantharidis*, E.; and *Unguentum picis nigræ*, L.

Oil of Turpentine (*Terebinthinæ oleum*, E. L. D.), often called in common speech Spirits of turpentine, is obtained, like resin, not from the turpentine of the Scotch-fir alone, as the Pharmacopœias of London and Dublin have indicated, but from various turpentines, and chiefly at present, in Britain at least, from the American variety, the produce of the swamp-pine of the United States. It is prepared by distillation either in the dry way, or more generally with water; by the latter of which means a finer product is obtained. In this state however it always requires to be purified for medical use. This is done by repeating the distillation with water alone, as the Pharmacopœias direct, or still better from a solution of caustic potash, as is now practised by some English manufacturers (Pereira). The purified oil (*Oleum terebinthinæ purificatum*, E. L.—*rectificatum*, D.) is a transparent, colourless, very liquid fluid, varying in density from 866 to 880. It possesses in general

a powerful, penetrating, balsamic, peculiar odour, which differs somewhat according to the turpentine whence it is derived or the heat used in distilling it; and it has a disagreeable aromatic, bitter, and sometimes acrid taste, which also varies with the same circumstances. The blandest kinds are said to be procured from American and Venice turpentine or Canada-balsam, and by the process of distillation with water not carried too far. The odour and taste may be removed in a great measure by agitating it repeatedly with an eighth of its volume of rectified-spirit (Nimmo); but its composition is probably altered by the process. It boils at 312°, and the temperature rises to 350° as the ebullition proceeds. A cold of −17° causes it to deposit crystals, which are a hydrate of the pure oil. At a high temperature it burns with a fierce, dense, red flame and much black smoke. Under exposure to the air it slowly absorbs oxygen and becomes thick. It is very sparingly soluble in water, moderately so in alcohol, and readily in ether. It inflames when immersed in chlorine gas; and iodine dropped into it is partly dissolved, and partly dispersed with an explosion. It absorbs muriatic acid gas in large quantity, and is converted into a crystalline compound called Artificial-camphor, which consists of one equivalent of acid and one of the radical oil of turpentine, called by Dumas Camphene. It dissolves resins, fixed oils, fats, many alkaloids and neutral crystalline principles from the vegetable world, and also caoutchouc.—The variation of the temperature as its distillation proceeds would lead to the supposition that ordinary purified turpentine-oil is not a simple oleaginous principle; and accordingly late investigations seem to show, that it consists of several proximate principles, the most abundant of which is nearly tasteless and scentless, while another concentrates in itself the taste and odour of the drug (Blanchet and Sell). When recent it is probably a pure hydro-carbon; but when kept for some time it always contains a little oxygen. The radical oil, or that part which enters into combination with muriatic acid gas, is composed, according to Dumas, of ten equivalents of carbon and eight of hydrogen, that is, 88.24 and 11.76 per cent, by weight; and Blanchet and Sell have obtained the same results with oil prepared from Alsace-turpentine, and purified by distilling it from chloride of calcium. This principle is Camphogen or the Camphene of M. Dumas. It forms camphor by combining with one equivalent of oxygen; and with two equivalents of the same element it forms camphoric acid.

Actions and Uses.—Oil of turpentine is the most important of the medicinal agents derived from the natural products of the pines. Its actions are complex. Physiologically it is irritant, stimulant, cathartic, diuretic, and diaphoretic. According to some it is also in large doses a narcotic, and in small doses a tonic. Therapeutically it is anthelmintic, and, in relation to chronic mucous discharges, an astringent.

It acts externally with promptitude as an irritant, producing redness of the skin, an eruption of pimples, and sometimes minute blisters. It is therefore much in use as a counter-irritant upon the abdomen in peritonitis, or in the neighbourhood of indolent tumours and chronic topical inflammations generally, and likewise as a stimulant for chilblains, indolent ulcers, caries of the bones, sloughing, especially from pressure in exhausting diseases, chronic inflammation of the edge of the eyelids, and recent burns. In the last affection it had at one time a high name, chiefly owing to the recommendations of Dr Kentish; but the treatment by cotton and pressure has in a great measure displaced it.

When given inwardly in large doses, it seems occasionally to produce in man a feeling like that of intoxication, or a state resembling trance; and it causes in animals tetanus, coma, and speedy death. Sometimes again it excites in the human subject pain in the stomach, sickness, and vomiting, obviously from a local irritating action. More frequently it gives rise to violent strangury, bloody urine, and other symptoms of irritation in the kidneys or bladder. Most frequently of all, however, large doses merely cause purging. All these effects are uncertain. Where purging occurs, the other effects now mentioned scarcely ever present themselves. Where it does not occur, the most frequent result is strangury. But very large doses, even so much as three or four ounces, have been taken without injury. In small doses of fifteen or thirty minims frequently repeated, oil of turpentine is a stimulant,—quickening the pulse, raising the animal heat, and even producing some degree of exhilaration; and when this action is kept up steadily, it is held by some to operate as a tonic, and to be therefore useful in the typhoid stage or form of continued fever, in erysipelas attended with low symptomatic pyrexia (Copeland), and in puerperal fever (Brenan). Its general stimulant influence is often attended with diaphoresis; and hence it has been a good deal employed in chronic rheumatism and neuralgia (Cheyne). Its cathartic properties are undoubted, yet not to be depended on. It acts on the bowels with greater certainty in large than in small doses, but more certainly still if given with other purgatives such as castor-oil. A mixture of this kind has often moved the bowels in obstruction from long-continued constipation, after other powerful cathartics had failed. Its influence is peculiarly apt to be directed on the urinary organs. This happens sometimes when it is given in large doses as a purgative, should it fail to act as such, but more frequently when small doses are administered repeatedly. In all circumstances it passes off by the urine, and communicates to that secretion a strong odour of violets. Occasionally it induces violent strangury, with discharge of blood, and tendency to suppression of urine. Most generally it merely increases the flow of urine; and on this account it has been used by some as a di-

uretic in dropsy and in suppression. Dr Pereira has found it serviceable in the latter affection. It has been also said to possess the remarkable property of increasing the lithic acid in the urine; and it certainly appears at times to bring on lithiasis in those whose fits of gravel are habitually carried off by copious discharge of lithic acid and lithate of ammonia. Like some other volatile oils, it tends to diminish excessive mucous discharges, and has accordingly been used with apparent advantage in chronic catarrh, chronic dysentery, chronic diarrhœa, but above all in chronic inflammation of the urinary bladder. Its most unequivocal therapeutic action is that of a vermifuge, in worms generally, but above all in tape-worm. In this variety, which resists most other anthelmintics, oil of turpentine taken inwardly is the most certain of all remedies, next to pomegranate root-bark. For ascarides it is more useful in the form of clyster. In the same form it is likewise very serviceable for removing tympanitic distension in typhoid fever, peritonitis, and other febrile or abdominal diseases. It has farther been given empirically in epilepsy, chorea, hysteria, croup, colic, and jaundice; but its utility in these diseases is doubtful.—In the course of its action it is absorbed; for through whatever channel it enters the body, an odour of turpentine is imparted to the breath and perspiration, and a violet odour is acquired by the urine.

The best form for applying oil of turpentine outwardly is the *Linimentum terebinthinæ.* It is given internally in the form of emulsion. A good form of this kind for frequent use in small doses is made by triturating a drachm of the oil with the yolk of an egg, and adding gradually a drachm each of spirit of cinnamon and syrup, with an ounce and a half of water. As a cathartic its best form is that of an emulsion along with castor-oil. Six drachms of castor-oil and two of oil of turpentine, with an ounce of peppermint-water and twenty minims of Aqua potassæ, make a powerful purgative mixture. When given in large doses as a vermifuge, it should be first carefully triturated with the yolk of one egg for every two drachms, and then diluted to the patient's wish with water, plain or aromatised. The Pharmacopœias all contain a formula for administering it as an injection.

Tar (*Pix liquida,* E. L. D.) has been used immemorially in medicine. It is the πισσα ὑγρα of Dioscorides. It is prepared in the northern parts of Europe, by digging a hole in the earth near a bank, filling it with the root-wood and billets of the branches of Scotch fir, covering the whole with turf, and kindling the wood at the top so as to let it burn slowly with a smothered heat. During the process tar is formed, which, trickling down to the bottom, is received in an iron pan, whence it escapes by a pipe in the side of the bank. In other parts of the world, as in India, it is got by fixing in a pit in the earth a large earthen pot with a hole in its bottom, which opens into a smaller pot placed below,—then filling the upper pot with wood and surrounding it with dried cows' dung

for fuel,—and collecting in the lower vessel the tar which is produced by the process called *Destillatio per descentum.* Tar is largely imported into this country from Russia and other northern countries of Europe, and likewise from North America. It is a thick viscid liquid of a dark brownish-black colour and peculiar odour. It dries up slowly when exposed to the air. Heat expels from it acetic acid, water, and an impure volatile oil, called Oil of tar, which consists of oil of turpentine holding in solution various products of destructive distillation; and if the process be carried far enough, pitch is left as the residuum. Water agitated with tar acquires its odour and a wine-yellow colour; and is impregnated with its oil and acid and a trace of creasote, constituting the nostrum called Tar-water (*Aqua picis liquidæ*, D.) Alcohol, ether, and the oils, both fixed and volatile, dissolve tar. It is a very complex substance; nor is its composition yet thoroughly understood. It contains modified resin, modified oil of turpentine, acetic acid, and water; and some kinds of it yield creasote, paraffin, eupion, and other products of the destructive distillation of vegetable substances discovered by Reichenbach. In the vicinity of Edinburgh creasote and paraffin are obtained largely from Archangel tar.

Tar is in its action a stimulant, diaphoretic, and diuretic. Tar-water, in consequence of the strenuous recommendations of Bishop Berkeley, was employed for some time as a calmative and expectorant in diseases of the chest and of the kidneys; but, though admitted into the Dublin Pharmacopœia, it is now abandoned in practice. More recently the inhalation of tar-vapour was brought into repute by Sir Alexander Crichton in catarrhal and phthisical complaints; but this remedy too is already obsolete. The only use now prevalently made of tar is as a local application for some chronic diseases of the skin, more especially porrigo, tinea capitis, lepra, and psoriasis. It is considered by many a valuable remedy in these diseases. According to my own observation, it is the best of all topical applications in lepra and psoriasis, and one of the best in porrigo. The form for these purposes is the *Unguentum picis liquidæ.* Oil of tar is poisonous in large doses. The dose of tar-water is a pint or two.

Pitch (*Pix arida*, E., *Pix nigra*, L. D.) is unnecessarily retained in the Pharmacopœias. It is the bituminous matter left after tar has been heated to expel its water, acetic acid, and oil. It is the ξηρα πισσα, or dry pitch, of Dioscorides. It is black, firm, shining in fracture, fusible at a gentle heat, and composed of modified resin, with various products of the destructive distillation of vegetable substances.

It has been used inwardly as a stimulant and diaphoretic in scaly cutaneous diseases, and outwardly in the form of the *Unguentum picis nigræ*, L., commonly called the Black Basilicon Ointment,

for dressing indolent ulcers, or as an application for porrigo and tinea. Its properties are probably all possessed, and in greater energy, by tar.

TEREBINTHINA CHIA, *E. L. D.* *Liquid resinous exudation of Pistacia Terebinthus, L. W. DC.* *Chian Turpentine.*

FOR NAMES.—*Fren.* Térébenthine de Chio.—*Ital.* Trementina di Cipro.—*Ger.* Cyprischen terpentin.

FIGURES of Pistacia Terebinthus in Hayne, xiii. 19.—Nees von E. 352.—St. and Ch. iii. 129.

CHIAN TURPENTINE was the Ῥητινη τερμινθου of Dioscorides. It is now scarcely ever used in the medicine of western Europe.

The plant which produces it, the *Pistacia Terebinthus*, is a low, handsome tree of Linnæus's class and order *Diœcia Pentandria*, and of the Natural family *Terebinthaceæ* of Decandolle or *Anacardiaceæ* of Lindley. It grows naturally in most parts of the south of Europe, but thrives especially in the Grecian Archipelago, Asia Minor, and Northern Africa. It sometimes attains the height of thirty or thirty-five feet. The turpentine is obtained from incisions, and is chiefly collected on the island of Scio. A single tree yields towards ten ounces. This turpentine is scarce in English commerce, and pine-turpentines are generally substituted for it. It has the consistence of honey, a pale yellowish-green colour, considerable translucency, a rather fragrant terebinthine odour, approaching that of fennel, and a feeble taste like that of mastic without any bitterness or acridity (Guibourt). It slowly becomes concrete, and passes to the state of a resin. It is composed of resin and volatile oil, but has not been lately analysed.

It possesses in all probability the therapeutic actions of the pine turpentines; but little is known positively of its properties; for it is scarcely put to any use except in Eastern Europe as a masticatory. Discorides considered it the best of all the turpentines, and says it is a diuretic, stomachic, and laxative.

TEREBINTHINA VENETA. See *Terebinthina.*

TEREBINTHINAE OLEUM. See *Terebinthina.*

TESTAE, *L. D.* See *Calcis Carbonas.*

TIGLII OLEUM *L.* See *Crotonis oleum.*

TOLUIFERA BALSAMUM. See *Balsamum Tolutanum.*

TORMENTILLA, *E. L. D.* *Root of Potentilla Tormentilla, Sibthorpe, Fl. Oxon. DC. Spr.* (Edin. Lond.)—*of Tormentilla officinalis, Smith, Fl. Brit.* (Dub.)

DECOCTUM TORMENTILLÆ, L.

PROCESS, *Lond.* Take of
Tormentil, bruised, two ounces;
Distilled water, a pint and a half.
Boil to a pint and strain.

For. Names.—*Fren.* Tormentille.—*Ital.* Tormintilla.—*Span.* Tormentila.—*Port.* Tormentilla.—*Ger.* Fingerkraut ; Ruhrwurzel.—*Swed.* Blodrot.—*Russ.* Uzik ; Zavjazmk.

Figures of Potentilla Tormentilla as Tormentilla erecta in Hayne, ii. 48.—Nees von E. 309.—St. and Ch. i. 26.

The Root of Tormentil is a very old article of the Materia Medica; but it is difficult to assent to the doctrine of Sprengel that it was the root of the Πενταφυλλον of the Greeks, the description of which by Disocorides does not correspond with the modern *Potentilla Tormentilla*.

The plant belongs to the Linnæan class and order *Icosandria Polygynia*, and to the Natural family *Rosaceæ* of Decandolle and Lindley. It has been variously named even by recent botanists *Potentilla Tormentilla*, DC. Spr., *Tormentilla erecta*, Willd., and *Tormentilla officinalis*, Smith. It is a very common plant on dry hilly pastures in this and other European countries. It has a tuberous root-stock, about the thickness and length of the upper joint of the fore-finger, tough, woody, and provided with numerous radicles. It is deep brownish-red externally, and flesh-red within. Its taste is strongly astringent. Water dissolves its astringent principle, and forms an infusion, which gives a greenish-black precipitate with the sesquioxide salts of iron, and a grayish curdy one with the solution of isinglass. It contains 17.5 per cent of tannin, with much colouring matter, gum, and other unimportant ingredients.

Tormentil-root is a powerful astringent, and one of the most active indigenous drugs of the class. Although now scarcely ever used, it is equally applicable with catechu, kino, and other astringents of foreign origin, to the treatment of chronic dysentery and other chronic mucous discharges.

The dose of its only officinal preparation, the *Decoctum tormentillæ*, L. is fl.unc. i. ad fl.unc. iii.

TOXICODENDRON, *L. D.* *The leaves of Rhus Toxicodendron, L. W. DC.* *Poison-ivy.*

For. Names.—*Fren.* Sumac vénéneux.—*Ger.* Gift-sumach.—*Russ.* Geltnik iadovitoi.—*Dut.* Vergiftboom.—*Swed.* Förgiftiga trädt.

Figures of Rhus toxicodendron in Hayne, ix. i.—Nees von E. 353.—St. and Ch. iii. 167.

The leaves of *Rhus Toxicodendron* were first introduced to the notice of physicians in Europe by Dr Alderson in 1794. After a temporary celebrity, they have been almost abandoned.

The plant is a low creeping shrub, common in Canada and the United States. It belongs to the Linnæan class and order *Pentandria Trigynia*, and to the Natural family *Terebinthaceæ* of Decandolle, or *Anacardiaceæ* of Lindley. Like other species of the genus, it has a milky acrid juice ; which, on exposure to the air, absorbs oxygen and becomes black. The leaves, the officinal part, are ternate, and the leaflets oval-lanceolate, acuminate, and

pubescent. They have an astringent taste, with some acridity when fresh, and scarcely any when dry. They have not been analyzed; but the acridity is probably owing to a volatile principle (Van Mons).

The fresh juice of the poison-ivy is powerfully irritant. It produces in some persons blistering of the skin where it is applied, with much symptomatic fever; and even the emanations from the plant are alleged to have the same effect on certain constitutions. The juice and leaves taken internally are narcotico-irritant in large doses; and in small doses they are held to be diuretic, diaphoretic, laxative, and, in respect to the nervous system, stimulant.—The leaves have been used in various diseases, but chiefly in chronic palsy, on account of their stimulating action on the nervous system. Their therapeutic effect is said to be attended with twitches of the paralysed muscles and pricking of the affected limb, like those produced by strychnia and nux-vomica. Cases of the cure of palsy under their use continue to be occasionally reported in the medical journals. If this remedy is to be retained in the Pharmacopœias, the preparation for use ought to be either a tincture of the fresh leaves or an extract from the same prepared in vacuo; for its active part is very volatile.

The dose of the powdered leaves is gr. i. ad gr. v. repeatedly, till pricking commences.

TRAGACANTHA, *E. L.* GUMMI TRAGACANTHÆ, *D.* *Gummy exudation from Astragalus verus, Olivier, Voyage —D. C.—and other species* (Edin.)—*Concrete juice of Astragalus verus, Olivier* (Lond.)—*Gum of Astragalus creticus, D. C.* (Dub.)

MUCILAGO TRAGACANTHAE, E. D.

PROCESS, *Edin. Dub.* Take of
Tragacanth, two drachms;
Boiling water, 9 (8, D.) fluidounces.
Macerate for four and twenty hours, triturate to dissolve the gum, and strain. (Macerate in a close vessel till the gum be dissolved, and strain the mucilage, D.)

PULVIS TRAGACANTHAE COMPOSITUS, E. L.

PROCESS, *Edin. Lond.* Take of
Tragacanth, bruised;
Gum-arabic, bruised, and
Starch, of each an ounce and a half;
Pure sugar, three ounces.
Reduce the starch and sugar to powder, add the tragacanth and gum-arabic, and pulverize the mixture thoroughly.

FOR. NAMES.—*Fren.* Gomme adragant.—*Ital.* Gomma adragante.—*Span.* Goma tragacanto; Goma alquitira.—*Port.* Alcatira.—*Ger.* Tragant.—*Swed.* Dragant.—*Dan.* Tragant.—*Arab.* Samaghulkatad; Kaseera.—*Tam.* Vadomocottay pisin.—*Beng.* Kuteera.

FIGURES of Astragalus verus in Nees von E. 329.—Hayne, x. 7.—Olivier, Voyage, iii. 44.—Astragalus gummifer, in Hayne, x. viii.—Labillardiere, Journ. de Phys. 1790.—Astragalus creticus, in Decandolle, Astragalogia, 33.—St. and Ch. iv. 161.

UNDER the title of Τραγακανθη Dioscorides mentions a gum-bear-

ing plant, which may be presumed to be the *Astragalus aristatus* of Greece, the source of one variety of gum-tragacanth.

Natural History.—TRAGACANTH is obtained from several species of plants, all belonging however to the genus *Astragalus*. The genus is arranged in Linnæus's class and order *Diadelphia Decandria*, and in the Natural family *Leguminosæ*. Linnæus erroneously referred the drug to his *Astragalus Tragacantha*, now *A. massiliensis*, a species inhabiting the south of France and northern Africa, which is known not to yield any gum. Tournefort in the beginning of last century referred it from personal observation to a species he found on Mount Ida in the Troad, now *A. creticus*, and which probably yields an inferior gum, seldom met with in the English market. Labillardière towards the close of last century found upon Mount Lebanon a species now known as *A. gummifer*, which yields a still coarser gum in large masses. About the same time Sibthorpe ascertained that the *A. aristatus*, considered by him to be the Dioscoridean species, produces on the Grecian continent, as well as in Cyprus, a sort of Gum called in modern Greek *τϱαγακανθα*, which in his time was annually exported to Italy. Sibthorpe's account has been recently confirmed by Landerer, who has found that a kind of tragacanth is collected from this species on the hills near Patrass about 3000 feet above the level of the sea, and is still exported to Venice and Trieste, or as Levant-tragacanth to Marseilles and Ancona. Subsequently to Sibthorpe, Olivier ascertained, that, throughout Natolia, Armenia, northern Persia, and Koordistan, a gum of the nature of tragacanth is collected from various species of *Astragalus*; but that what is seen in European commerce is probably obtained in a great measure from *A. verus*, a species which he was the first to characterise. This is a shrub about three feet high, growing naturally in Persia, Armenia, and Asia Minor. Gum-tragacanth exudes from the stem naturally or after incisions; and it is gathered from July till September. Finally, Professor Lindley found, that of two plants sent to this country by Mr Brant, English consul at Erzeroum, as those which produce the tragacanth of Toorkistan, one, which is said to yield "the white or best variety" of tragacanth, is the *Astragalus gummifer* of Labillardière, while the other, which yields "the red or inferior" tragacanth, is a new species described under the name of *A. strobiliferus* (Bot. Reg. 1841). There is no positive evidence however in Professor Lindley's statement, that Mr Brant's observations refer to the tragacanth of English commerce.

Chemical History.—The tragacanth of British commerce comes from the Levant. It presents the appearance of very thin, pale grayish, or grayish-yellow, almost parchment-like plates or scales, marked by spiral or circular ridges. It is semitransparent or translucent, tasteless, and without odour. Its density is 1384. It is very tough, and may be most easily pulverized between 100° and 120°, F Cold or boiling water converts it into a mucilage,

the *Mucilago tragacanthæ* of the Pharmacopœias. If cold water be used, the mucilage consists principally of a bulky jelly, very diffusible, yet not soluble; but a boiling temperature enables water to effect nearly complete solution. Iodine turns the mucilage blue, owing to the presence of a little starch.—Different views have been taken of the composition of tragacanth. Guerin-Vary considers it a compound of 53.3 of arabin or soluble gum, 33.1 bassorin, 11.1 water, and 2.5 ashes; and the principle bassorin, so named because it abounds in gum-bassorah, is, according to this chemist, the insoluble ingredient which water converts into a jelly. The same principle, or one very like it, exists in many imperfectly soluble gums. Guerin-Vary regards it as composed of 37.28 per cent of carbon, 55.87 oxygen, and 6.2 hydrogen, $= C^9 H^{11} O^{11}$. Guibourt takes a different view of the constitution of tragacanth. He considers it a compound, chiefly of a peculiar, mucilaginous principle, which is insoluble in cold water, but capable of swelling in it and diffusing itself, so as even in part to penetrate a filter, and of forming a mucilage different in chemical properties from that of arabin; and the remainder he views as a mixture of starch and ligneous fibre presenting none of the characters of bassorin. Mulder regards it, together with other vegetable mucilages, as being merely an impure form of pectin or pectic acid. These statements correspond with the prior observation of Dr Duncan, that mucilage of tragacanth, unlike that of gum-arabic, does not yield any precipitate with silicate of potash.

Besides the tragacanth now described, another variety, rare in English commerce, but more common upon the continent, occurs in the vermicular form, and is thought to be produced by *Astragalus creticus.*——I have received from the Apothecary-General's Department at Calcutta another variety, the Kuteera, or tragacanth of Hindostan, which is in thick, tough, hard, translucent masses, ridged like an oyster-shell, and weighing occasionally two ounces. Its botanical source and commercial origin are unknown to me.

Actions and Uses.—Tragacanth possesses the nutritive and demulcent properties of the gums generally. It is seldom put to use now on account of these properties, but is chiefly employed in the form of mucilage for suspending heavy powders in mixtures. For this purpose the mucilage and the compound powder of tragacanth are convenient preparations.—It may be observed, however, that there is scarcely any pharmaceutic application of tragacanth, for which gum-arabic does not answer equally well, if not better.

TUSSILAGO, *L. D. Herb (leaves and flowers, D.) of Tussilago Farfara, L. W. DC. Spr. Colt's-foot.*

FOR. NAMES.—*Fren.* Pas D'âne.—*Ital.* Tossilagine.—*Span.* Tussilago.—*Port.* Tossilagem.—*Ger.* Huflattich.—*Dut.* Hoefblad.—*Swed.* Hüsthof.—*Dan.* Hestehov.—*Russ.* Belokopitnik ; Podbel.

FIGURES of Tussilago Farfara in Hayne, ii. 16.—Nees von E. 237.—Engl. Bot. 429.—St. and Ch. i. 20.

COLT'S-FOOT is the Βηχιον of the Greeks, and *Tussilago* or *Farfara* of the Latins.

It is a common weed upon moist banks in all parts of Europe, and in many parts of Asia. It belongs to the Linnæan class and order *Syngenesia Superflua*, and to the Natural family *Compositæ* of Decandolle, or *Asteraceæ* of Lindley. It is easily known by its yellow asteraceous flowers, appearing in spring, and by the roundish heart-shaped, toothed, inferiorly-hairy leaves which follow. The whole plant has a glutinous, bitterish, obscurely acrid taste, but is without odour. It has not been analyzed.

Colt's-foot was long an esteemed demulcent tonic in chronic coughs of all kinds, and it still possesses considerable reputation in domestic practice. Its credit in the classic ages, more than any recognized efficacy in modern times, has led to its being retained by the English and Irish Colleges in their Pharmacopœias. It is used in the form of a strained decoction, which is usually given along with milk.

ULMUS, *L.* ULMI CAMPESTRIS CORTEX, *D.* *Elm-Bark.*

DECOCTUM ULMI, L. D.

PROCESS, *Lond. Dub.* Take of Fresh elm-bark, two ounces (and a-half, L.) Water, two (old wine, D.) pints. Boil down to a pint, and strain.

THERE is certainly no reason for retaining this bark in the Pharmacopœias. The tree is the Πτελέα of Dioscorides. The bark is bitter, mucilaginous, and astringent.

UVA-URSI. *Leaves of Arctostaphylos Uva-Ursi, Spr.* (Edin. Lond.) *Leaves of Arbutus Uva-Ursi, L. W.* (Dub.) *Bearberry.*

DECOCTUM UVÆ-URSI, L.

PROCESS, *Lond.* Take of Uva-ursi, bruised, an ounce; Distilled water, a pint and a half. Boil down to a pint and strain.

EXTRACTUM UVÆ-URSI, L.

PROCESS, *Lond.* To be prepared from Uva-ursi like extract of Gentian.

FOR. NAMES.—*Fren.* Bousserolle; Raisin d'ours.—*Ital.* Corbezzola uva d'orso.—*Span.* Gayuba.—*Port.* Uva di urso.—*Ger.* Sandbeere; Bärentraube.—*Dut.* Beerendruif.—*Swed.* Mjölon.—*Dan.* Meelbær riis.—*Russ.* Tolokniankа.

FIGURES of Arctostaphylos Uva-ursi as Arbutus Uva-ursi in Nees von E. 215.—Hayne, iv. 20.—Engl. Bot. 714.—St. and Ch. ii. 91.

THE period of the introduction of this plant into medical practice is unknown. Geiger says it was used in the south of Europe for the first time about the beginning of last century, and in Ger-

many not for fifty years later. It cannot be traced with confidence to any of the medicinal plants of the Greeks or Romans.

Natural and Chemical History.—The *Arctostaphylos Uva-ursi*, or bear-berry, is a common perennial evergreen in the northern countries of Europe and America, and is a native of Britain. It belongs to the Linnæan class and order *Decandria Monogynia*, and to the Natural family *Ericineæ* or *Ericaceæ*. It is a low, creeping, and rooting shrub,—with small, deep green, shining, coriaceous, obovate leaves, not unlike those of box-wood,—small, bell-shaped, white flowers tipped with red,—and scarlet berries about the size of a currant. The officinal part is the leaf. This is apt to be confounded with the leaf of the *Vaccinium Vitis-idæa*, or whortleberry, a plant of the same Natural family. The uva-ursi leaf however is reticulated beneath, while the whortle-berry leaf is dotted. The box-leaf, which is sometimes substituted for the uva-ursi, is easily known by its want of astringency. The true leaf has a bitterish and strongly astringent taste, and when in powder an odour somewhat like that of hay. It readily parts with its astringency to water and rectified-spirit. Its watery infusion gives a copious bluish-black precipitate with the sesquioxide salts of iron. Meissner found the dried leaves to contain 36.4 per cent of tannin, with a little gum, resin, extractive, and other unimportant ingredients.

Actions and Uses.—Uva-ursi is a powerful astringent; and according to some it is also diuretic. Its astringent virtues led to its being much employed in chronic mucous discharges, more especially from the genito-urinary organs, such as gonorrhœa, vesical catarrh, and fluor albus in their chronic stages or forms. Its utility in these affections led to its more general use as a specific in diseases of the kidneys and bladder at large. It seems to have sometimes a soothing as well as astringent effect in such disorders; but it is far from meriting the high name it enjoyed in that respect during the close of the past and beginning of the present century. In recent times it has been succeeded, as a panacea in urinary diseases, by the Pareira-brava-root,—probably without sufficient reason. As an astringent it has proved serviceable in chronic dysentery, in menorrhagia, and in diabetes.

The doses of its preparations are *Uvæ-ursi pulvis*, gr. x. ad gr. lx. —*Decoctum uvæ-ursi*, L. fl.unc. i. ad fl.unc. iii.—*Extractum uvæ-ursi*, gr. v. ad gr. xv.

UVAE PASSAE, *E.* UVA, *L.* FRUCTUS VITIS EXSICCATUS, *D.* *Dried fruit of Vitis vinifera, L. W. DC. Spr.* (*deprived of its acini*, Lond.) *Raisins.*

FOR. NAMES.—*Fren.* Raisins-secs.—*Ital.* Uva passa; Passola.—*Span.* Pasas. —*Port.* Uvas passadas.—*Ger.* Rosinen.—*Dut.* Rozijnen.—*Swed.* Russin.—*Dan.* Rosiner.—*Arab.* Zebeeb.—*Pers.* Mewuz.—*Tam.* Dividatsipalavuttil — *Beng.* and *Hind.* Kishmish.

FIGURES of Vitis vinifera in Nees von E. 369, 370.—Hayne, x. 40.—St. and Ch. iii. 140.

THE GRAPE-VINE has been cultivated immemorially. Its varieties have consequently been rendered so numerous that it is impossible to give a useful sketch of its history within moderate compass in this work.

Natural History.—It belongs to the Natural family *Sarmentaceæ* of Decandolle or *Vitaceæ* of Lindley, and to the Linnæan class and order *Pentandria Monogynia.* Its original native country is doubtful, but is generally thought to have been Palestine. It occurs in wild localities in the southern parts of Asia, and also on the Grecian continent. It is now cultivated extensively in numberless parts of the globe. With due care it may be made to ripen its fruit in the open air in most seasons in the south of England. The fruit is a berry, which varies much in size, colour, and flavour. When dried in the sun or with artificial heat, it constitutes the only officinal article obtained directly from the vine,—the dried-grape or RAISIN.

Two kinds of raisins are in common domestic use, the Currant or Corinthian raisin (*Passulæ minores* of many continental Pharmacopœias), and the Common raisin, often termed simply the raisin (*Passulæ majores*). The former is obtained from a very small black grape scarcely so large as a pea, which is produced on the Grecian continent and islands. It is imported largely into this country, being in general use for making cakes, puddings, and the like; but it is not employed in medicine or pharmacy. The medicinal raisin is the common kind usually called raisin, of which there are numberless varieties, imported principally from Spain and the Levant. The most esteemed is that called Muscatel raisin, from the grape which is used for preparing it. Raisins are variously prepared,—sometimes by drying them in the sun or by artificial heat, without any preparatory measure, sometimes by steeping the grapes in the first instance in an alkaline ley. The process seems not to be a case of simple desiccation merely; for the dried grape contains more sugar and less acid than when fresh.

Chemical History.—Raisins consist, like grapes, of a peculiar kind of sugar, bitartrate of potash, a little malic and citric acids, gum, extractive, and a glutenoid matter somewhat allied to yeast in its properties. Grape-sugar differs from cane-sugar in being crystallizable only in irregular grains, less soluble in water or alcohol, and less powerfully sweet. Its composition is also different; for according to the most recent analyses it consists of twelve equivalents of each of its elements, carbon, hydrogen, and oxygen ($C^{12}H^{12}O^{12}$). In consequence of this composition, when it undergoes fermentation, it is simply resolved into alcohol and carbonic acid, without any of its constituents being lost, or any being added from other sources (see *Saccharum.*)

Raisins are nutritive and demulcent. They are not easily di-

gested alone. They are chiefly used in pharmacy for covering the taste of drugs, or for imparting due consistence to their officinal forms. They are employed in preparing the *Decoctum althææ* of the Edinburgh and Dublin Colleges, the Edinburgh *Decoctum guiaci compositum*, the Dublin and London *Decoctum hordei compositum*, the London and Edinburgh *Tinctura cardamomi composita*, the *Tinctura sennæ composita* of the same Colleges, and the Edinburgh *Tinctura quassiæ composita.*

VALERIANA, *E. L. D.* *Root of Valeriana officinalis, L. W. Spr. DC.* *Valerian.*

INFUSUM VALERIANAE, L.

PROCESS, *Lond.* Take of
Valerian, half an ounce;
Boiling distilled water, a pint.
Infuse for half an hour in a covered vessel and strain.

TINCTURA VALERIANAE, E. L. D.

PROCESS, *Edin. Lond.* Take of
Valerian, bruised, five ounces;
Proof-spirit, two pints.
Proceed by percolation or digestion as for tincture of Cinchona (*Edin.*) Macerate for 14 days and strain (Lond.)
PROCESS, *Dub.* Take of
Valerian, in powder, four ounces;
Proof-spirit, two (old wine) pints.
Macerate seven days and strain.

TINCTURA VALERIANÆ AMMONIATA, E. D. TINCT. VALER. COMP. L.

PROCESS, *Edin. Dub.* Take of
Valerian, bruised, five ounces (powder, two ounces, D.)
Spirit of ammonia, two pints (old wine measure, D.)
Proceed by percolation, or by digestion in a well-closed vessel as for tincture of cinchona (*Edin*). Macerate for seven days and strain (*Dub*).
PROCESS, *Lond.* Take of
Valerian, bruised, five ounces;
Aromatic spirit of ammonia, two pints.
Macerate fourteen days and strain.

FOR. NAMES.—*Fren.* Valériane.—*Ital. Span.* and *Port.* Valeriana.—*Ger.* Baldrian.—*Dut.* Wilde Valeriaan.—*Swed.* Vändelrot.—*Dan.* Baldrian.—*Russ.* Bulderian aptetschnoi.

FIGURES of Valeriana officinalis in Nees von. E. 254.—Hayne, iii. 32.—Engl. Bot. 698.—St. and Ch. ii. 54.

THE officinal VALERIAN has been used in European medicine for several centuries, and was probably first resorted to as a substitute for the Greek valerian, the Φου of Dioscorides, the *Valeriana Dioscoridis* of modern botany, to which plant the present officinal species bears some resemblance.

Natural History.—It is the root of the *Valeriana officinalis*, or common valerian, a plant of the Linnæan class and order *Triandria Monogynia*, and of the Natural family *Valerianaceæ.* It grows abundantly in this and other European countries in moist soils, and sometimes on dry banks. It has a perennial root, and an annual herbaceous stem from two to four feet in height, which produces in the autumn several umbellated heads of lilac flowers. The root, which is sometimes collected in spring before the stem rises (Duncan), and sometimes in the autumn when the leaves have decayed, consists of a tuberous root-stock, and numerous radicles about half a line in thickness, and towards four inches long. This is the officinal part. It has a bitter, acrid taste, and a peculiar, penetrating

odour, not disagreeable in the fresh plant, but fetid when the root is dry, and more especially if long kept. It imparts its properties readily to water, rectified spirit, and ammoniated spirit, which are the menstruums for its three officinal preparations, the *Infusum* and *Tinctura valerianæ*, and the *Tinctura valerianae ammoniata*.

Chemical History.—Valerian root consists according to Trommsdorff, of 71 per cent of woody fibre, 9.4 extractive, 12.5 resinous extractive, 6 resin, and rather more than one per cent of volatile oil. The oil is greenish, of a very powerful, penetrating valerian odour, and of a warm aromatic taste. When valerian is distilled with water, there passes over along with the oil, a peculiar volatile fatty acid, termed valerianic acid, which is capable of uniting with bases, and forming salts, some of which have been used medicinally. The most recent experiments seem to have established that the valerianic acid does not exist naturally in the root, but is a product of the oxidation of a portion of the oil; and this change seems to occur most readily and completely when the oil is exposed to the air in contact with caustic bases, such as potash or baryta (Thirault). Valerianic acid can also be got by the action of caustic potash on the oil of potatoe-spirit (Dumas and Stass). The constitution of valerianic acid is $C^{10}\ H^{9}\ O^{3}$ (Ettling).

Adulterations.—Valerian is liable to adulteration with other roots on the continent, but not in this country. Every species of valerian-root has more or less the same odour; but in none is it so powerful as in the *V. officinalis.*

Actions and Uses.—This drug is a powerful stimulant of the diffusible class, and consequently antispasmodic and calmative. It is likewise considered by some to be tonic, and by others to possess anthelmintic virtues. It was once used in this country, and is still used in Germany, as a tonic stimulant in typhoid fever attended with unusual nervous disturbance. It has been recommended as a remedy in epilepsy; and though generally neglected, it is sometimes of service in that form of the disease which appears about puberty. Its most important application is in the treatment of hysteria, and it is here a remedy of undoubted service, especially in the milder forms of the disease, and for removing the restlessness and irritability which occur in hysterical constitutions.—The best officinal preparation in the British Pharmacopœias is the ammoniated tincture. But German physicians also use its volatile oil, probably the most convenient and energetic of all its forms, though in this country little known as a remedy. Vogel has stated that no other antispasmodic equals it in dispelling the paroxysm of hysteria.

The officinal forms and their doses are: *Pulvis valerianæ*, gr. xx. ad gr. xl.—*Tinctura valerianæ*, fl. dr. ss. ad fl. dr. ii.—*Tinctura valerianæ ammoniata*, fl. dr. ss. ad fl. dr. ii.—*Infusum valerianæ*, L. fl. unc. i. ad fl. unc. ii.

VERATRIA. See *Sabadilla*.

VERATRUM. *Rhizoma* (*Root, L. D.*) *of Veratrum album, L. W. Spr. White Hellebore.*

DECOCTUM VERATRI, L. D.

PROCESS, *Lond. Dub.* Take of
Veratrum, bruised, an ounce (ten drachms, L.);
Water, two pints (distilled, L.);
Rectified spirit, two fluidounces.
Boil the veratrum in the water down to a pint; add the spirit after cooling, squeeze and strain.

UNGUENTUM VERATRI, L. D.

PROCESS, *Lond. Dub.* Take of
Veratrum, in powder, 3 (2, L.) ounces;
Lard, prepared, one pound (eight ounces, L.);
(Oil of Lemons, twenty minims, L.)
Mix them together.

VINUM VERATRI, L.

PROCESS, *Lond.* Take of
Veratrum, sliced, eight ounces;
Sherry, two pints.
Macerate for fourteen days and strain.

FOR. NAMES.—*Fren.* Hellebore blanc.—*Ital.* Elleboro bianco.—*Span.* Vedegambre blanco.—*Port.* Helleboro branco.—*Ger.* Nieswurz.—*Dut.* Nieswortel.—*Swed.* Hvit prustrot.—*Russ.* Tshemeritza.

FIGURES of Veratrum album in Nees von E. 46.—Hayne, xiii. 26.—Steph. and Ch. iii. 136.

THE modern *Veratrum album* is believed to be the Ἐλλέβορος λευκος or White hellebore of the Greeks, though the Dioscoridean description of that plant is somewhat inapplicable.

Natural and Chemical History.—It belongs to the Linnæan class and order *Polygamia Monœcia*, and to the Natural family *Colchicaceæ* of Decandolle, and *Melanthaceæ* of Lindley. It has a very extensive range throughout southern, central, and northern Europe (Hayne); but it is not a native of Britain. It has a stem towards four feet high, composed of the long leaf-stalks enclosed within one another,—large plantagineous leaves,—and a large branchy panicle of numberless, pale greenish-yellow flowers. The root consists of numerous undivided radicles attached to a cylindrical wrinkled fleshy root-stock, about two inches long, blackish externally when fresh, but brownish when dry, and internally grayish-brown. The officinal part of the plant, according to the Edinburgh College, is the root-stock only; but the two other Colleges add the radicles, although they are scarcely ever attached to the root-stock as it is imported. White-hellebore-root has a taste at first sweetish, and then intensely, disagreeably, and permanently bitter and acrid. According to Pelletier and Caventou it owes its acridity and other properties to the alkaloid veratria, which they discovered in this root and cevadilla seeds (see *Sabadilla*); and Simon has also announced in it the presence of another alkaloid, which he calls Jervina, but whose properties are still undetermined.

Actions and Uses.—White-hellebore is a violent irritant poison, which occasions, when snuffed into the nostrils, severe coryza, and when swallowed, urgent vomiting and profuse diarrhœa. When it proves fatal, narcotic symptoms are superadded, such as stupor and convulsions. It was at one time used as an emetic and purgative in mental diseases, as a diaphoretic in chronic cutaneous diseases, and as a sternutatory in headache, amaurosis, and ophthal-

mia. Afterwards, in consequence of being supposed to constitute the chief ingredient of the Eau Medicinale d'Husson, it came into general use as a remedy for arresting the paroxysm of gout. At present however it is little employed, partly on account of the frequent complaints made of its uncertain action, partly because in the most important of its applications, the arrestment of gout, it has been displaced by colchicum. Its principal use now is for the destruction of vermin that infest the skin.—Its best preparation for internal use is the London wine.

The doses of its officinal preparations are: *Pulvis veratri*, gr. ii. ad gr. viii.—*Decoctum veratri*, L. D. for external use.— *Vinum veratri*, L. min. xxx. ad min. lx.—*Unguentum veratri*, L. D. externally. It forms part also of the London *Unguentum sulphuris compositum*.

VERBASCUM, *D.* *Leaves of Verbascum Thapsus, L. W. Spr. Great Mullein.*

For. Names.—*Fren.* Molène ; Bouillon-blanc.—*Ital.* Verbasco.—*Span.* Gordolobo.—*Port.* Verbasco branco.—*Ger.* Wollkraut.—*Dut.* Wollekruid.—*Swed.* Kongsljus.—*Dan.* Kongelys.—*Russ.* Zarskie skipeta.

Figures of Verbascum Thapsus in Nees von E. 158.—Hayne, xii. 38.

The *Verbascum Thapsus* of modern botany was one of the species included by Dioscorides under his Φλομος or Φλονος.

It is a native of this island and of most parts of the European continent. It belongs to the Linnæan class and order *Pentandria Monogynia*, and to the Natural family *Solanaceæ*, according to some botanists, and the *Scrophulariaceæ*, according to Nees von Esenbeck and others. It is a biennial plant. In its second summer it pushes up a stem from two to six or eight feet tall, the upper part of which is a long dense spike of yellow flowers. The leaves, like the stem, are covered everywhere with long woolly down. They are sometimes confounded with the leaves of digitalis; from which they differ in being downy on both surfaces, and in having a much more feeble bitter taste. They have been analyzed, but not with any interesting result so far as regards pharmacology. (Morin).

Verbascum leaves are emollient and probably in some measure narcotic. Their properties however are feeble; and they have therefore been abandoned in practice in this country. They were employed at one time in chronic catarrh and other affections of the chest attended with cough. The form for use is an infusion or decoction.

VINUM ALBUM, *E.* VINUM XERICUM, *L.* VINUM ALBUM HISPANICUM, *D.* *Sherry.*

For. Names.—*Vinum album*—*Fren.* Vin de Xeres.—*Ital.* Vino di Xeres.—*Span.* Vino blanco. —*Port.* Vinho branco.—*Ger.* Spanischer wein.—*Dut.* Zoete

Spaansche wijn.—*Swed.* Spanskt win.—*Dan.* Spanske viin.—*Russ.* Ispanskie vino.

Vinum.—*Arab.* Khumar. –*Pers.* Mey.—*Beng.* Sherab unghovric.—*Hind.* Drakh ka mud.—*Sansc.* Mada ; Madira.

WE have the authority of the Sacred writings for the fact, that WINE was first made by the patriarch Noah. The earliest medical records mention it as an article used in the treatment of diseases.

The only species of wine admitted into the British Pharmacopœias is SHERRY ; and the only reason for its admission there is, that it constitutes a good menstruum for the administration of various drugs. But as wine in several of its forms is also an important remedy on its own account, the subject requires more detailed consideration in the present work.

Chemical History.—All wines, properly so called, are obtained from the grape as their sole or principal source ; but the term is also sometimes extended to analogous liquors derived from other fruits, or from the sap of certain trees. Wines are produced by fermentation of grape-juice. The juice in the unripe state is called verjuice ; and it contains malic, citric, and tartaric acids, bitartrate of potash, sulphates of potash and lime with other inorganic salts in less proportion, a little tannin, and extractive matter. As the fruit ripens, gum appears in the juice, and grape-sugar (see p. 933) is formed in large quantity, in part at the expense of the citric and tartaric acids. And in the ripe state of the fruit, the juice, which is then called Must, contains essentially sugar, gum, malic acid, bitartrate of potash, various inorganic salts, extractive and colouring matters, and a small quantity of an insoluble glutenoid substance, or variety of ferment, which appears to be derived from the cells of the husk, but does not form essentially a part of the juice itself (Fabbroni). So long as the ripe grape remains entire, it undergoes little change beyond gradual desiccation, and a farther conversion of its acid into sugar. But if the grape be crushed, or its juice expressed, and the temperature maintained about 70° F., fermentation ensues through the action of the air and of the glutenoid principle from the husk ; which here performs the same part that yeast discharges in the fermentation of malt or solutions of sugar. The consequence is the gradual disappearance of sugar, the escape of carbonic acid, and the formation of alcohol, as formerly explained (see *Saccharum*) ; and it is probable that some alcohol is also formed at the expense of part of the tartaric acid in the bitartrate of potash. There is also developed (Liebig and Pelouze) a volatile ethereal aromatic substance in small quantity, which is called Oenanthic-ether ; but possibly this principle exists originally in the juice (Zenneck). When the process reaches a certain stage, the liquor, at first very turbid under the effervescence

of fermentation, becomes gradually clear, of a peculiar odour and taste called Vinous, and of a pale straw-colour if the juice only was used, or if the grape have a colourless husk, but of a fine amber or deep-red colour if the husks were red and not separated. Left in this state to itself, the grape-juice, now become wine, would ere long, under the influence of its ferment, undergo farther changes, and lose its vinous character. But this is prevented, first by the action of sulphurous acid vapour on the ferment, and afterwards by removing this principle entirely, as well as any other floating impurities, by a mixture of isinglass and white of egg; whose gelatin and albumen,—forming bulky precipitates, the former with the tannin of the wine, the latter by coagulation under the influence of its alcohol,—and carrying down with them all fine insoluble particles,—accomplish what is called the process of fining. Sometimes the process of fermentation is arrested at an early stage, while a considerable part of the sugar remains unaltered; and in this way are obtained the Sweet wines. In other instances, when the fermentation is more advanced, but without its being arrested, the wine, after undergoing peculiar management, is corked up in strong bottles; so that, as it continues to ferment, it becomes charged with carbonic acid. Wines of this kind are called Sparkling wines. Much more generally the fermentation is permitted to go on, till by far the greater part of the sugar has disappeared, and the liquor becomes still. For the most part such wines are subsequently kept for some time in casks, to undergo the process of ripening, during which bitartrate of potash is deposited in crusts along with colouring matter, while what remains of the sugar of the juice slowly undergoes complete conversion into alcohol. These wines, in contradistinction to the first denomination, are called Dry wines. Many of the weaker wines with difficulty sustain the process of ripening in the cask, but undergo decay unless bottled at an early period. Most strong wines however, and especially the stronger kinds of white wine, may be treated thus with safety for many years,—retaining all the while their vinous character, improving in flavour, decreasing somewhat in alcoholic strength, and evaporating through the wood till even only a half or a third of the original volume of liquid remains. Most wines, but particularly the strong deep-coloured wines, also undergo changes after being bottled. These changes have not been carefully studied, but a crust of bitartrate of potash and colouring matter is deposited, any remaining sweetness gradually vanishes, and the aroma is much heightened, probably without any increase in the proportion of alcohol.

Wines considered generally, consist of water, alcohol, sugar, resino-mucilaginous extractive, colouring matter, tannin, bitartrate of potash, malic acid, carbonic acid, œnanthic ether, and volatile oil. Sugar, carbonic acid, and tannin exist in some wines only;

in many malic acid is present in very minute quantity; and the greater part are free of tannin, or nearly so. They differ much from one another in the respective proportions of their constituents. These differences depend partly on original differences in the grape, partly on differences in climate or cultivation, partly on differences of management before, during, and after fermentation, and sometimes upon express additions being made, to alter the flavour.

The varieties of wine are consequently innumerable. They are variously divided according to their sensible qualities, their leading constituents, or their commercial sources. In reference to the application of their dietetic and medicinal properties to the practice of medicine, the principal wines may be conveniently classed in the first instance as Still, Sparkling, and Sweet wines. The first and most important class may be divided into strong and weak wines. The former division may be farther subdivided into Portugal wines, including Red and White Port, and White wines properly so called, including Sherry, Malaga, Alicant, Paxarete and other Spanish white wines, Dry Lisbon, Madeira, Teneriffe, Sercial, Marsala, and Cape-Madeira. The division of weak still-wines includes first Bordeaux or Claret, Burgundy, Sauterne, and many other white wines of France, and secondly the greater number of German wines confounded in common speech in this country under the two designations of Hock and Moselle. Sparkling wines comprehend chiefly Champagne and Sparkling Moselle. Sweet wines, which however have scarcely a place in the Materia Medica, are principally Tokay, Frontignan, Constantia, Sweet Lisbon, Malmsey, and Rives-Altes. Many other wines, more rarely met with in Britain, would equally find a place in the preceding arrangement; but they are of no consequence in the medical practice of this country. The best wines for practical use, to be met with generally in this country, are Port, Sherry, and Madeira among the stronger wines,—and among the weaker, Claret, Hock, Moselle, and, though more seldom admissible, Champagne.

The alcohol contained in these wines, their most important ingredient in a medicinal point of view, varies from six to seventeen per cent by weight. The proportion in particular wines has been variously represented by different analysts. My own opinion, in which I am supported by Chevallier,* is that it has generally been overestimated. The following tables represent,—first, the per-centage by measure of rectified-spirit of the density 825 contained in a great number of wines, as determined by Mr Brande in 1811,—secondly, the per-centage of spirit by volume in various French wines, as ascertained by M. Julia-Fontenelle,—and thirdly, the per-centage of absolute alcohol by weight, as well as that of proof-spirit by volume, in the chief wines used in Britain, from experiments of my own made in 1838, and published briefly in the Proceedings of the Royal Society of Edinburgh for 1838-39.

Mr Brande's Table.

Rectified-Spirit (825 *Dens.*) *by volume in* 100.

Scotch whisky,		54.32
Irish whisky,		53.90
Rum,		53.68
Brandy,		53.39
Hollands,		51.60
Lissa wine,	strongest,	26.47
	mean,	25.41
	weakest,	24.35
Raisin wine,	strongest,	26.40
	mean,	25.12
	weakest,	23.20
Marsala,	strongest,	26.03
	mean,	25.09
	weakest,	25.05
Port,	strongest,	25.83
	mean,	22.96
	weakest,	21.40
Madeira,	strongest,	24.43
	mean,	24.17
	weakest,	23.93
Currant wine,		20.55
Cape Madeira,	strongest,	22.94
	mean,	20.51
	weakest,	18.11
Red Madeira,	strongest,	22.30
	mean,	20.35
	weakest,	18.40
Sercial,	strongest,	21.40
	mean,	20 34
	weakest,	19.24
Teneriffe,		19.79
Colares,		19.75
Constantia, white,		19.75
Lacryma Christi,		19.70
Sherry,	strongest,	19.83
	mean,	19.17
	weakest,	18.25
Vidonia,		19.25
Lisbon,		18.94
Bucellas,		18.49
Constantia, red,		18.92
Calcavalla,	strongest,	19.20
	mean,	18.65
	weakest,	18 10
Cape muscat,		18.25
Rousillon,	strongest,	19.00
	mean,	18.13
	weakest,	17.26
Grape wine,		18.11
Malaga,	strongest,	18.94
	mean,	18.10
	weakest,	17.26
White Hermitage,		17.43
Alba flora,		17.26
Zante,		17.05
Malmsey,		16.40
Shiraz,		15.52
Lunel,		15.52
Syracuse,		15.28
Claret,	strongest,	17.11
	mean,	15.10
	weakest,	12.91
Nice,		14.63
Burgundy,	strongest,	16.60
	mean,	14.57
	weakest,	11.95
Sauterne,		14.22
Barsac,		13.86
Champagne,	still,	13.30
	sparkling,	12.80
Tent,		13.30
Rives Altes,		12.79
Vin de Grave,	strongest,	13.94
	mean,	13.37
	weakest,	12.80
Côte-Rôtie,		12.32
Red-Hermitage,		12.32
Gooseberry-wine,		11.84
Hock,	strongest,	14.37
	mean,	12.08
	weakest,	
Champagne, red,	strongest,	12.56
	mean,	11.93
	weakest,	11.30
Orange-wine,		11.26
Tokay,		9.88
Elder wine,		8.79
Cyder,	strongest,	9.87
	mean,	7.54
	weakest,	5.21
Perry,		7.26
Burton ale,		8.88
Edinburgh ale,		6.20
Dorchester ale,		5.56
Average of ales,		6.87
Brown-stout,		6.80
London porter,		4.20
Small beer,		1.28

M. Julia-Fontenelle's Table.

Alcohol by volume in 100.

Bamyulls,	21.96
Rives Altes,	21.80
Colliouvre,	21.62
Lapalme,	20.93
Mirepeisset,	20.45
Salces,	20.43
Narbonne,	19.90
Lezignan,	19.46
Leucate de Fitou,	19.70
Montagnac,	19.30
Nissan,	18.80
Mèze,	18.60
Bezieres,	18.40
Lunel,	18.10
Montpellier,	17.65
Carcassone,	17.22
Frontignan,	16.90
Bourgogne,	14.75
Bordeaux,	14.73
Champagne,	12 20
Toulouse,	11.97

Table from the Author's Experiments in 1838.

	Alc. by weight in 100 parts.	Proof-sp. by vol. in 100 parts.
Port, weakest,	14.97	30.56
mean of 7 wines,	16.20	33.91
strongest,	17.10	37.27
White Port,	14.97	31.31
Sherry, weakest,	13.98	30.84
mean of 13 wines not long in cask,	15.37	33.59
Sherry, strongest,	16.17	35.12
mean of 9 long in cask in E. Indies,	14.72	32.30
Madre da Xeres,	16.90	37.06
Madeira long in cask in the East Indies,	14.09	30.80
strongest,	16.90	37.00

	Alc. by weight in 100 parts.	Proof-sp. by vol.
Teneriffe, long in cask at Calcutta,	13.84	30.21
Sercial,	15.45	33.65
Dry Lisbon,	16.14	34.71
Shiraz,	12.95	28.30
Amontillado,	12.63	27.60
Claret, first growth 1811,	7.72	16.95
Chateau Latour, Do. 1825,	7.78	17.06
Rosan, 2d growth 1825,	7.61	16.74
Vin Ordinaire, Bordx.	8.99	18.96
Rives Altes,	9.31	22.35
Malmsey,	12.86	28.37
Rudesheimer, first quality,	8.40	18.44
Rudesheimer, inferior,	6.90	15.19
Hambacher, 1st qual.	7.35	16.15
Edinb. ale, unbottled,	5.70	12.60
Same ale, 2 years bot.	6.06	13.40
London porter, four months in bottle,	5.36	11.91

The alcohol of most true wines is derived solely from the fermentation of the sugar, or alteration of the acids, contained in the grape-juice from which they are produced. In others the proportion is increased by adding starch-sugar before or during fermentation. In others again it is added directly in the form of brandy, partly to please the palate of consumers, partly because it is thought necessary to make the wine keep well. The strong wines commonly used in Britain, such as Port, Sherry, and the like, are almost all strengthened in this manner, and frequently also the inferior sorts of Bordeaux wines. It has been stated that brandied may be distinguished from unbrandied wines by heating the wine in an open saucer, while there is suspended close to the surface a small lamp with several wicks. If the wine contain adventitious spirit it escapes at a very moderate elevation of temperature, and takes fire; but if the wine contain only its original alcohol, inflammation does not occur till it is in full ebullition (Journ. de Chem. Med. 1844).—As alcohol in the shape of wine is held to be more digestible and less intoxicating than in its pure forms, some have supposed it to be in a peculiar state of combination with the other principles in wine. However this may be, it is easily separated, not merely by distillation, but likewise by the action of carbonate of potash, which has a strong affinity for water, and none for alcohol.—The alcoholic strength of wines is held by many to increase with age, so long as the wine continues sound, and more especially if evaporation be allowed to take place from the cask for a length of time. But this is a mistake, as the contents of the third table given above will prove. The flavour however of old wine ripened in this way is much heightened; and the apparent strength, or body, as it is called, is increased.

Bitartrate of potash is most abundant in new wine, and diminishes with keeping, partly by deposition, partly by transformation into other principles. Its presence in unusual proportion renders wine tart, as in many of the inferior wines of France and Germany. The cause of tartness however is more often owing to the presence of malic acid. It is worthy of notice, that the tartness occasionally observed in some superior Bordeaux wines, if owing merely to an unusual amount of bitartrate of potash, disappears

altogether in no long time as the wine ripens in the bottle. Tartness however may be likewise owing to the development of acetic acid, in consequence of the liquor having passed beyond the vinous fermentation; but the presence of a very small proportion of this acid takes away in a great degree its vinous flavour and constitution. All unusual tartness in wine, from whatever cause it originates, renders it comparatively unfit for medical use.

The other solid contents of wine, which are probably unimportant in relation to its therapeutic properties, are small in amount except in sweet wines. The sugar of sweet wines is generally abundant, makes them soon pall on the taste, and renders them little available in medical practice. The resino-mucilaginous extract, colouring matter, and tannin,—the last two of which are derived from the husk of the grape, and occur principally in red wines,—are never abundant, and diminish slowly with age. The total solid contents are scanty in every wine except the sweet kinds. In port and sherry, when fit for drinking, the solids seldom exceed three per cent; in Bordeaux wine they amount to about two and a half; and in Hock and Moselle to two per cent only.

The peculiar vinous flavour of wine, by which it is distinguished from all mixtures of ardent spirits, is mainly owing to the presence of a small proportion of the etherial substance discovered by MM. Liebig and Pelouze, and called by them Oenanthic-ether. It is said not to exceed a forty-thousandth part of the wine. It may be obtained towards the close of the distillation of wine on the great scale for making brandy. But Professor Zenneck seems to have shown that it also exists in the unfermented grape-juice. It is colourless, very mobile, of a powerful intoxicating odour, and a strong, peculiar, unpleasant taste. Its density is 862. It boils about 440°. Alcohol dissolves it; but it is insoluble in water, and passes over with it in distillation only in very small quantity. It consists of 18 equivalents of carbon, the same of hydrogen, and three equivalents of oxygen (Liebig and Pelouze). It seems to regulate the strength of the flavour of wine, or what is called its bouquet; but the quality of flavour peculiar to each sort depends on a volatile oil, either present in the juice from the first, or engendered during fermentation. The peculiar aroma of each wine, it is said, may be obtained by distilling 4 parts from 500 into a very cold receiver (Fauré). Oenanthic-ether is probably concerned in some way with the intoxicating qualities possessed by some wines, such as Burgundy, in a degree disproportioned to their mere alcoholic strength.

The presence of carbonic acid, which imparts to wine the property of sparkling, is an important circumstance in regard to the effects produced on the human body. All wines containing this ingredient possess the property of stimulating and intoxicating in a degree, and with a celerity, out of all proportion great in reference

to the amount of alcohol they contain; and their effects also pass off more quickly than those of other kinds of wine.

Adulterations.—It is impossible to enter here into the extensive subject of the adulteration of wines. Those which have become acetous are sometimes deprived of acidity by means of litharge or lime; to others for various causes sugar is added; but the most frequent of all malpractices is the manufacture of counterfeit wines in imitation of those in common use. The employment of lead for correcting acescency is easily discovered by the black precipitate occasioned on testing the wine with sulphuretted-hydrogen; and the use of lime for the same purpose may be detected by oxalate of ammonia occasioning a much larger precipitate of oxalate of lime than in a sound wine of the same class. These adulterations are less frequent in Britain than on the continent. The addition of sugar to wine in any shape renders the extract obtained by evaporation in the vapour-bath syrupy, instead of granular (Guibourt); but it must be remembered that many new wines present this character, because they contain some unfermented sugar. Counterfeit wines are to be detected satisfactorily only through means of their sensible qualities, and by an experienced connoisseur.

Actions and Uses.—The physiological action of wine is in most particulars the same with that of alcohol, as formerly explained. It is stimulant in small, and narcotic in large doses; and it possesses diuretic properties, though not in a conspicuous degree. There are some important differences however between the actions of wine and of alcohol which deserve attentive consideration. Wine is generally considered less inebriating than its equivalent alcohol in any other shape. And this fact has been vaguely referred to its alcohol being in a peculiar state of combination, so as to be more easily digestible. Notwithstanding the general admission of this peculiarity in the effects of wine, doubts may be entertained of the doctrine being so unequivocal, or so generally applicable, as late authors on wine have maintained; and I suspect it is founded in part on the mistaken notions that have prevailed as to the alcoholic strength of wines, which has been overrated by analysts,—and partly on a disregard of the influence of habit, which seems to render one species of alcoholic fluid more digestible, or in some other way less stimulating than another.—The stimulus of wine is longer maintained than that produced by the other forms in which alcohol may be administered. Hence too the tonic effects of small doses frequently repeated, especially during an enfeebled state of the nervous system, are more remarkable. It is also less apt to disorder the stomach when taken too largely; though to this rule there are many exceptions. Habitual over-indulgence is more apt to lead to gout and gravel; but on the other hand habitual excesses are less apt to occasion delirium tremens and diseased liver.

The special applications of wine are partly dietetic, partly medicinal. It is an unnecessary article of diet for all who are healthy,

robust, and engaged in an active occupation. But the artificial states of the constitution produced by the habits of civilized life are supposed to render it for some people a necessary stimulant especially during exposure to unusual fatigues. So far do some carry this notion in the upper ranks of society, as to follow the strange practice of allowing wine daily and in considerable quantity even to young healthy children. Very few constitutions of this kind really exist among those who are willing to think they themselves possess it. And there are extremely few persons, not hardened by the habitual use of wine, but will find that they sustain bodily fatigue and mental exertion as well at the time, maintain it as long, and suffer as little subsequently, under the practice of abstemiousness. At the same time it is impossible to admit, that the moderate use of wine, even though habitual, produces, except in certain habits, the evil effects on the bodily and mental powers, or eventually on the constitution, which some ascetics, reasoning from their own experience, would have the world imagine. In most cases the moderate use or entire avoidance of wine seems a matter of indifference, so far as the constitution is concerned. The habitual use of wine is safest or most salutary when the habit is united with regular exercise out of doors, and most hurtful where the occupation is sedentary, and the mind much exerted.——Of the wines in common use in Britain, the best for dietetic use is Sherry among the stronger sorts. Port also agrees with many, but to not a few is more stimulating than sherry of equal strength, more apt to disorder the stomach, and more frequently attended with constipation of the bowels. Madeira is more apt than either to cause acescency. Of the weaker class of wines, those of Germany are apt also to cause acescency; Burgundy occasions in many headach or indigestion; and Champagne is more apt than any other to bring on headach, and this even though taken in small quantity. Of all the weaker wines none answers better for dietetic purposes than the better qualities of Bordeaux. There are some, however, in whom this kind causes acescency, or otherwise disorders the stomach; and this peculiarity seems common in gouty constitutions, and even in some on whom the stronger wines of Spain and Portugal have no such effect. The digestibility of wine is much impaired by mingling several sorts. Even burgundy or champagne may be drunk with impunity if taken singly, although they disagree when united with other kinds.

The superior action of wine as a tonic gives it great advantages in general over other forms of alcohol in the treatment of diseases. It is important as a stimulant and tonic in the typhoid forms of continued fever; but much tact and experience are required for using it successfully. It is the more called for, the more purely the fever puts on the typhoid form. It should seldom be given before the close of the first week; and if really necessary much sooner, the prognosis is unfavourable. In many cases of mild typhus it is unnecessary at any stage till convalescence is formed. The best indica-

tions are a soft pulse and paleness of the features, also unusual prostration, subsultus, and other signs of nervous exhaustion. In dubious circumstances, where a trial is made, the signs of its being inapplicable are increase in the dryness of the tongue, flushing of the features, restlessness, labour in respiration, and jarring or frequency of the pulse, and its being distasteful to the patient. Wine is likewise useful in many cases of eruptive fevers, and even sometimes in acute local inflammation, when the symptomatic fever is typhoid; and its administration is regulated by the same rules as in idiopathic fever. The resumption of the habitual use of wine, previously abandoned, sometimes converts atonic into regular gout. It is the best stimulus to employ in cases of protracted fainting. It is sometimes serviceable in delirium tremens. In almost all states of chronic debility, unconnected with acute disease or with organic disorders within the head, and in almost all cases of convalescence from severe exhausting diseases at large, it is an efficacious tonic. It is contraindicated in acute fever and acute inflammations, in affections of the head, in most forms of dyspepsia, in diabetes till near the close, in most cases of gout, and for the most part in urinary gravel of the lithic kind.

The best wines for medical use are Port, Sherry, Madeira, and Bordeaux. The quantity required varies much with the object in view. In disease there is commonly more insensibility than usual to the stimulant action of wine than in health; so that larger doses are borne without intoxication resulting.

VIOLA, *E. D.* *Flowers of Viola odorata L. W. DC. Spr. March-violet.*

SYRUPUS VIOLAE, E. D.

PROCESS, *Edin.* Take of
Fresh violets, one pound;
Boiling water, two pints and a-half;
Pure sugar, seven pounds and a-half.
Infuse the flowers for twenty-four hours in a covered glass or earthenware vessel; strain without squeezing, and dissolve the sugar in the filtered liquor.

PROCESS, *Dub.* Take of
Fresh violet petals, two pounds;
Boiling water, fi e pints (old wine measure).
Infuse for twent -four hours; strain the liquor through : fine cloth, without expression; and tl en add sugar to make a syrup.

FOR. NAMES.—*Fren.* Violette odorante.—*Ital.* Viola marzia.—*Span.* Violeta.—*Port.* Violetta.—*Ger.* Märzveilchen.—*Dut.* Tamme viool.—*Swed.* Aekta fiolcr. *Dan.* Martsfioleer.—*Russ.* Pachutschaja fialka.

FIGURES of Viola odorata in Nees von E. 386.—Hayne, iii. 2.—Steph. and Ch. i. 29.

THE MARCH-VIOLET is the Ἴον πορφυροῦν of Dioscorides and other Greek physicians.

It belongs to the Linnæan class and order *Pentandria Monogynia*, and to the natural family *Violaceæ*, to which it has given its name. It grows in shady places in most parts of Europe, and also throughout Asia. It is a low perennial herb which puts forth numerous runners, bears roundish cordate leaves, and produces in

March and April blue flowers "so remarkable for their odour and colour, that they have given a name to both" (Duncan). The flower is the only officinal part. Druggists are supplied with it by the gardener, by whom the violet is cultivated for the purpose. The double cultivated variety is superior to the single (Guibourt). When dried with care, violet flowers retain their colour, and in part their fragrance. The best mode of preserving both properties is by means of sugar in the form of the *Syrupus violæ* of the Pharmacopœias. Even in this shape however the colour is fugacious.

The march-violet is principally used as a test of alkalinity and acidity, being rendered green by alkalis and red by acids. It is sometimes also employed for imparting colour or fragrance to mixtures of other drugs. It is not however altogether destitute of activity; for its syrup is laxative to children.——An observation of some interest has been made with regard to the roots of this and other species of the genus *Viola*,—that they all contain a principle analogous in external character to the emeta of ipecacuan, and possessing, like that alkaloid, powerful emetic properties (Boullay). It has not been particularly examined, but seems an alkaloid, and is termed Violina. This observation accounts for the emetic virtues long ascribed to the roots of various species of violet,—virtues so remarkable in the opinion of some, as to deserve more attention than the subject has hitherto received.

ZINCUM, *E. L. D.* *Zinc.*

TESTS, *Edin.* It dissolves in a great measure in diluted sulphuric acid, leaving only a scanty grayish-black residuum. This solution presents the characters of the solution of sulphate of zinc.

TESTS, *Lond.* Almost entirely soluble in diluted sulphuric acid; and the solution is colourless, and presents the properties of solution of sulphate of zinc.

FOR. NAMES.—*Fren.* Zinc.—*Ital.* Zinco.—*Span.* Zinc.—*Port.* Zinco.—*Ger. Dut. Swed. Dan.* and *Russ.* Zink.—*Tam.* Tootoonagum.—*Beng.* Sungbusrie.

ZINC must have been known from remote antiquity as part of certain alloys. It seems to have been first accurately distinguished and called by its present name by Paracelsus.

Chemical History.—Zinc is obtained from two of its ores, blende and calamine,—the former a sulphuret, the latter a carbonate of zinc, with various impurities. From the sulphuret it is usually separated by reducing the roasted ore with carbonaceous matter and detaching the metal by fusion; from calamine it is often obtained by a similar process of roasting and reduction, but at a temperature sufficient for its being separated by sublimation. Zinc however is also obtained, as a sort of refuse, from the chimneys of furnaces in which other metals are reduced, more especially lead. By all such methods it is separated in an impure state, being impregnated with various metals, particularly iron and copper, and a small proportion of arsenic. These impurities may be removed by sublim-

ing the zinc in close vessels, or by granulating and fusing it in contact with a fourth part of nitre (Meillet), but their proportion is not so great as to render commercial zinc unfit for medicinal purposes.

Zinc presents an irregularly lamellated fracture, a pale bluish-white colour, intermediate between that of tin and silver, and considerable brilliancy. It tarnishes under exposure to the air, owing to the formation of a thin crust of a suboxide. Its density is 6.862, varying, however, with its purity. Its hardness and toughness are considerable, and at ordinary temperatures it is not ductile or malleable. But about the temperature of boiling water, and a little higher, it becomes easily malleable, and may be rolled out into thin plates. Its density is thus increased to 7.215. This metal may in consequence be used for making a great variety of utensils. At a higher temperature, namely about 400°, it ceases to be malleable, and on the contrary is so brittle that it may be pulverized. It fuses at 680° according to Berzelius, at 773° according to Professor Daniell. At a white heat it sublimes in close vessels. But under exposure to the air it catches fire at a temperature not much higher than its melting point, and is converted into the protoxide of zinc, one of its officinal preparations. Zinc in its state of oxide forms soluble salts with most of the ordinary acids. All its soluble salts possess in a remarkable degree the property of astringency.

Zinc was at one time proposed, and a good deal used, for fabricating culinary vessels; but it is unfit for this purpose, because acid and fatty matters corrode and oxidate it. It is used in pharmacy for preparing the compounds of zinc.

ZINCI ACETAS, *D.* *Acetate of zinc.*

ZINCI ACETATIS TINCTURA, D.

PROCESS, *Dub.* Take of
Sulphate of zinc, and
Acetate of potash, of each one part;
Rectified-spirit, sixteen parts.

Triturate the salts together; macerate with the spirit for a week, agitating occasionally; and filter.

THERE seems no reason for supposing the ACETATE OF ZINC superior as an astringent to the more common salt, the sulphate. I do not know why the Dublin College prefers the more expensive menstruum, rectified-spirit, to mere water. The acetate is produced by double decomposition. In the Dublin process sulphate of potash is separated insoluble, and acetate of zinc remains dissolved in the spirit. There is an excess of acetate of potass in the Dublin formula, the correct atomic proportions being very nearly four of this salt to five of sulphate of zinc. The acetate of zinc may be crystallized by evaporation from its watery solution.

Its medicinal properties are those of the sulphate. It forms a common gonorrhœal injection.

ZINCI CARBONAS IMPURUM, *D.* CALAMINA, *E. L.*

Native Impure Carbonate of Zinc.

TESTS, *Lond.* Almost entirely soluble in sulphuric acid, with some effervescence, unless it has been well burnt. The solution gives with potash or ammonia a precipitate soluble in an excess of the alkali.

CALAMINA PREPARATA, E. L. CARBONAS ZINCI IMPURUM PREPARATUM, D.

PROCESS, *Edin. Lond. Dub.* Heat Calamine to a red heat, then triturate it, and reduce it to a very fine powder, as directed for chalk.

UNGUENTUM CALAMINAE, E. L. D.

PROCESS, *Edin.* Take of
Calamine prepared in the same way as prepared chalk, one part;
Simple cerate, five parts.
Mix them well together.

PROCESS, *Lond.* Take of
Calamine, and
Wax, of each half a pound;
Olive-oil, sixteen fluidounces.
Melt the wax in the oil, remove them from the fire, and as soon as they begin to concrete, add the calamine, and stir briskly until they be cold.

PROCESS, *Dub.* Take of
Impure carbonate of zinc, prepared and dried, a pound;
Yellow-wax ointment, five pounds.
Triturate the carbonate till it be reduced to a fine powder; add it to the melted wax, and mix them thoroughly.

FOR. NAMES.—*Fren.* Calamine; Zinc carbonaté.—*Ital.* Giallimina; Pietra calaminaria.—*Span.* Calamina; Piedra calaminar.—*Port.* Pedra calaminar.—*Ger.* Galmei; Zinkspath.—*Dut.* Calamijn-steen.—*Swed.* Gallmeja.—*Dan.* Galmei.—*Russ.* Galmei.

Two kinds of zinc ores are known to mineralogists by the name of CALAMINE. One is a silicate of the oxide of zinc, of which the beautiful Calamines of Cornwall are familiar instances. The other is the impure Carbonate of zinc. The latter is the only variety fit for medical use, the silicated calamines being much less easily soluble. The carbonated calamine is a very common zinc ore, abounding in England, Germany, and other European countries. It is hard, presents commonly a gray or bluish-gray tint, but sometimes a yellowish or reddish colour, has an earthy fracture, and is more or less completely soluble in acids with effervescence. In the shops it is met with in the form of a pale yellowish or dirty gray powder, which sometimes effervesces briskly with acids, but frequently very little or not at all, either because silicated calamine has been incorrectly used in preparing it, or because the ore has been strongly roasted before being pulverized. It is a very impure substance, containing generally iron and copper, with various earthy matters. It is sometimes adulterated with powdered sulphate of baryta (Brett). As it is used externally for various purposes, on account of which it must be in a state of fine division, the Colleges properly direct that it shall be pulverized by levigation. This process is much facilitated by previously roasting the ore with a pretty strong heat. But it must be observed that in this operation the carbonic acid is in a great measure, if not wholly, expelled. In fact the levigated powder or Prepared calamine of the shops effervesces very little with acids. Hence the name given to it by all the old Pharmacopœias and still retained by the Dublin College, namely the impure carbonate of zinc, is inapplicable.

This is an article of very little consequence, which might be

safely expunged from the Pharmacopœias. It can exert no action which is not possessed more powerfully by the purer compounds of zinc; and if a carbonate is to be retained at all, it should be introduced in the form of a pure salt. It is chiefly used as an astringent application, in the form of fine powder or of ointment, for the treatment of intertrigo and excoriations from pressure, of excoriated nipples, and of chronic ophthalmia, especially ophthalmia tarsi.

Its only officinal form is the *Unguentum calaminæ*, E. L. D.

ZINCI OXYDUM, *E. L. D.* *Pure oxide of zinc.*

TESTS, *Edin.* White; tasteless; entirely soluble in diluted nitric acid: this solution is not affected by nitrate of baryta, but gives with ammonia a white precipitate entirely soluble in an excess of the test.

PROCESS, *Edin.* Take of
Sulphate of zinc, twelve ounces;
Carbonate of ammonia, six ounces;
Dissolve each in two pints of water; mix the solutions; collect the precipitate on a cloth; wash it thoroughly; squeeze and dry it; expose it for two hours to a red heat.

PROCESS, *Lond.* The same as above, except that twelve ounces of sulphate, six ounces and a-half of sesquicarbonate, and 240 fluidounces of water for each, are employed.

PROCESS, *Dub.* Throw fragments of zinc in small portions at a time into a crucible heated red hot and inclined towards the mouth of the furnace, covering the crucible lightly with another crucible after each addition. Preserve the white sublimed powder.

UNGUENTUM ZINCI, E. L.—UNG. OXYDI ZINCI, D.

PROCESS, *Edin. Lond. Dub.* Take of
Oxide of zinc, one ounce;
Simple liniment (axunge, L., white wax ointment, D,) six ounces.
Mix them well together.

FOR. NAMES.—*Fren.* Oxide de zinc.—*Ital.* Protossido di zinco.—*Ger.* Zinkoxyd.—*Russ.* Okis zinka.

Chemical History.—AN impure OXIDE OF ZINC, known in the shops under the name of Tutty (Tutia, Cadmia fornacum), was long the only oxide of this metal in general use. It is obtained from the chimneys of furnaces in which various metallic ores are roasted, more especially those of lead or of zinc itself. This preparation, however, though still sometimes employed in domestic medicine, is now completely abandoned in regular practice; and it has been properly displaced in all the British Pharmacopœias in favour of a pure OXIDE OF ZINC.

Oxide of Zinc may be prepared of various degrees of purity, by a variety of processes. One method, the original process of modern chemistry, and which is still retained by the Dublin College, consists in oxidating the metal by combustion in atmospheric air. The fused metal takes fire about the temperature of 940°, and burns with an intense white flame; and a white powder is produced, which partly remains in the crucible, and partly rises in the air in fine fleecy particles, formerly known by the name of Philosophers' wool. For the successful management of this process it is not necessary to project the metal in successive small portions into the crucible, as directed by the Dublin College. The whole metal

may be introduced at once, and the oxide removed from the surface as it forms. In order to free the oxide from adhering metal, it should be agitated in water, and subsequently dried. When thus prepared, the oxide of zinc always contains more or less of the impurities which existed in the metal, but is nevertheless probably fit enough for every medicinal purpose. It may however be obtained at once more pure and more conveniently in the moist way, by decomposing sulphate of zinc with an alkali or alkaline carbonate; and this method has accordingly been preferred by the Colleges of London and Edinburgh. The oxide may be thus obtained by caustic alkalis, for example by ammonia; and such was the method recommended in the earlier editions of the London Pharmacopœia. Ammonia, however, when in excess, redissolves some of the oxide; and the other caustic alkalis have the same effect. It has therefore been thought preferable to precipitate the oxide in the form of carbonate, and to expel the carbonic acid subsequently by heat; and the ammoniacal carbonate is preferred, because any adhering alkali is removed in the last stage of the process. The proportions recommended by the London College occasion a slight excess of the ammoniacal salt; which should be avoided.

Oxide of zinc, (*Nihil Album; Lana philosophica; Flores zinci; πομφολυξ* of Galen), when pure, is white, tasteless, and insoluble. At a low red heat it acquires a yellow colour, and on cooling recovers its whiteness, if quite pure. At a low white heat it fuses, and at a full white heat it undergoes sublimation. It is equally soluble in caustic alkaline solutions, and in the diluted ordinary acids, but less so in solution of carbonate of ammonia. It consists of one equivalent of each element (ZnO), and is therefore composed of 32.3 of metal and 8 of oxygen. It is thrown down in the form of a hydrate by caustic alkalis from the soluble salts of zinc.

Adulterations.—Its adulterations are chiefly with sulphate of zinc, carbonate of lime, and oxide of iron. The nitrate of baryta will detect the first of these, after the oxide is dissolved in nitric acid. Carbonate of lime will be left by ammonia, which readily dissolves the oxide; and oxide of iron will also be left in the same circumstances in the form of a fleecy yellowish powder. Carbonate of lead, which might also be employed to adulterate it, will be best detected by sulphuretted-hydrogen occasioning a black precipitate, instead of a white one, with its solution in a diluted acid.

Actions and Uses.—The oxide of zinc is used in medicine as an astringent and tonic. Externally it is employed in the form of ointment for healing up indolent ulcers and excoriations. It is particularly serviceable in chaps and excoriations of the nipples, and also in the excoriations produced by contact of the urine, or by pressure of the body in cases of long confinement to bed from lingering diseases. It is likewise a good application in chronic ophthalmia. It has been thought to correct the tendency of

the vesicles of herpetic eruptions to pass into suppuration. Internally, it has been used chiefly as a tonic in epilepsy, and sometimes with advantage. In other convulsive and spasmodic diseases, more especially spasmodic cough, occasional benefit has been derived from it; and favourable reports have been given of its action as a tonic and astringent in chronic catarrh. As an astringent it is also not without use in chronic diarrhœa. Lastly, it is a favourite tonic with some in various scaly cutaneous diseases, more especially lepra and psoriasis; in which it is usually given along with the solution of potash. It may be given internally as powder, or as a pill made with conserve of roses; and externally it is used either in the form of ointment, or sprinkled in the state of powder.

Its preparations are: *Pulvis oxidi zinci*, gr. i. ad viii. *Unguentum zinci* for external use.

ZINCI SULPHAS, *E. L. D.* *Sulphate of zinc.*

Tests, *Edin.* When a solution in six parts of distilled water is boiled with a little nitric acid, and ammonia is then added till the oxide of zinc first thrown down is redissolved, no yellow precipitate remains, or a trace only, and the solution is colourless.

Tests, *Lond.* Entirely soluble: The precipitate by ammonia is white, and entirely soluble in an excess of that alkali: Precipitated by muriate of baryta or acetate of lead.

Process, *Edin.* This salt may be prepared either by dissolving fragments of zinc in diluted sulphuric acid till a neutral liquid be obtained, filtering the solution, and concentrating sufficiently for it to crystallize on cooling,—or by repeatedly dissolving and crystallizing the impure sulphate of zinc of commerce, until the product when dissolved in water does not yield a black precipitate with tincture of galls, and corresponds with the characters laid down for sulphate of zinc in the list of the Materia Medica (see *Tests* above).

Process, *Lond. Dub.* Take of
Fragments of zinc, five ounces (thirteen parts, D.);
Diluted sulphuric acid, two pints (strong acid, twenty parts, diluted with water, 120 parts, D.)
Add the acid gradually to the zinc, filter when the effervescence is over, boil down till a pellicle forms, and crystallize.

For. Names.—*Fren.* Sulphate de zinc; Couperose blanche.—*Ital.* Solfato di zinco; Vetriolo bianco.—*Span.* Vitriolo blanco.—*Port.* Vitriolo branco.—*Ger.* Schwefelsaures zinkoxyd; Weisser vitriol.—*Swed.* Hwit witriol.—*Dan.* Hwid vitriol. —*Russ.* Sernokisloi zink; Veloi kuporos.

Sulphate of Zinc was known in the fourteenth century; but its nature and composition were first ascertained in 1735 by the German chemist Brandt (Geiger).

Chemical History.—When zinc is brought in contact with diluted sulphuric acid, it is oxidated at the expense of the water, and at the same time dissolved by the acid, while hydrogen gas escapes. By evaporation fine transparent colourless crystals are obtained, which are sulphate of zinc. Although this process is retained in the last editions of the Pharmacopœias, sulphate of zinc is now generally prepared for the shops not thus, but by purifying the crude sulphate which is obtained from the native sulphuret of zinc, or zinc-blende of mineralogists. For this purpose the ore is first roast-

ed, and then exposed to the air in a moist state till the sulphuret is converted by oxidation of its sulphur and metal into the sulphate; and the solution obtained by lixiviating the product, after being duly concentrated, is poured into moulds, where it concretes into compact cakes like loaf-sugar. It is thus prepared largely near the mines of Goslar in the Harz. In this crude state the salt contains many impurities, such as copper, cadmium, lead, and especially iron; the last of which, by passing to the state of peroxide under atmospheric exposure, imparts to the mass first a cream colour and then an ochre tint. The crude salt is purified partially by roasting, dissolving, and crystallizing it, and more thoroughly by dissolving it, immersing metallic zinc in the solution so as to displace the other metals, and then obtaining crystals by evaporation. A little iron is commonly still left behind, but not more than is usually contained in the sulphate as made by the College processes from the zinc of commerce. Most of the sulphate of zinc used in Britain is prepared by this method, and on the large scale by the manufacturing chemist.

Sulphate of zinc (White Vitriol) is commonly sold in the form of broken down acicular crystals, but sometimes in fragments of large four-sided prisms. By careful crystallization it may be obtained in regular crystals, which are rhombic prisms, usually truncated on two opposite edges, and often so much as to become prisms with six sides. It is a transparent and colourless salt, without odour, but of an intense disagreeable, astringent, and metallic taste. It effloresces under exposure to the air. When heated, it first fuses in its water of crystallization, which is subsequently driven off; and at a higher temperature the anhydrous salt parts with the whole or a great portion of its acid. It is soluble in two parts and a-half of water at 60°, and in considerably less at 212°. It is insoluble in alcohol. Its watery solution is precipitated white by the alkalis or their carbonates, oxide or carbonate of zinc being thrown down; and either precipitate is soluble in an excess of any caustic alkali, or of carbonate of ammonia. Ferrocyanate of potash also occasions a white precipitate. Sulphuretted-hydrogen gas throws down a white sulphuret of zinc, and constitutes the best reagent for distinguishing this metal in solution. Crystallized sulphate of zinc is composed of one equivalent of base, one of acid, and seven equivalents of water ($ZnO + SO^3 + 7$ Aq.), and consequently of 40.3 oxide, 40.1 acid, and 63.0 water.

Adulterations.—The adulterations of sulphate of zinc, as it is usually met with in the shops, are unimportant. It is usually free of copper, and ought not to contain any. But it is seldom quite free of oxide of iron; nor is a faint ferruginous impregnation of any importance in a medicinal point of view. If there is much iron present however, the salt is unfit for making eye-washes along with astringent vegetable substances, because an inky fluid is formed, owing to the production of tannate of iron.—Both impurities will

be detected readily by the Edinburgh method of testing. The nitric acid peroxidates the iron, and then the ammonia, redissolving the precipitated oxide of zinc, leaves the oxide of iron in yellow flakes, and, should copper be present, communicates a blue colour to the solution. I have never found iron entirely wanting, either in the salt of commerce, or in what was expressly made by dissolving commercial zinc in diluted sulphuric acid. The London College is therefore not quite correct in stating that the precipitate by ammonia is entirely soluble in an excess of the test; for scarcely any of the sulphate of zinc to be found in the shops would stand that criterion; neither is such extreme purity necessary.

Actions and Uses.—The actions and special uses of sulphate of zinc are numerous. Externally, it is in extensive use as an astringent, for collyriums in chronic ophthalmia, for injections in chronic gonorrhœa and fluor-albus, and also, though less frequently, for desiccative lotions in cases of old ulcers, as well as for gargles in aphthous sore throat and relaxation of the uvula. The lotion for ophthalmia should contain at first only one or two grains per ounce; a gonorrhœal injection may contain four grains; and in cases of fluor-albus it may be often used with advantage considerably stronger. Its employment in the acute stage of gonorrhœa, though recommended by some, is unsafe, on account of the risk of secondary disorders being induced. It is an inconvenient gargle, by reason of its horrible and persistent taste.—Internally, sulphate of zinc is an irritant poison in large doses; but it seldom produces injurious effects, because it is in general discharged promptly by vomiting. In doses somewhat less, for example in the quantity of fifteen, twenty or thirty grains, it is a powerful emetic, the most certain perhaps in the whole Materia Medica, and at all events the most certain among those which are safe. It is therefore currently preferred to every other where a prompt and powerful emetic is wanted, and especially in all kinds of narcotic poisoning. For this purpose it is administered in a state of solution in three ounces of water. In doses still less than what are required to excite vomiting, it acts as a powerful internal astringent and tonic; and as such it is a good deal used in chronic mucous discharges, especially chronic catarrh, chronic gonorrhœa, and fluor-albus. I have often given it with the best effects in obstinate chronic gleet in doses varying from three to six grains twice or thrice a-day. I have likewise seen the same treatment very successful in inveterate fluor-albus, but not so frequently. As a tonic, it has been employed, like the oxide of zinc, in various spasmodic diseases, but without satisfactory evidence of its utility. When given for any other purpose except as an emetic, it should be administered in the form of pill, to prevent as much as possible its tendency to cause sickness. When used internally as an astringent, it is apt to constipate the bowels; which must be attended to where it is taken for a length of time.

No injurious results of any other kind flow from its long-continued employment, as in the case of some metallic drugs.

The preparations of sulphate of zinc and their doses are: *Sulphas zinci*, gr. i. ad gr. vi. astringent or tonic, gr. xv. ad gr. xxx. emetic. *Liquor aluminis compositis*, L. for external use.

ZINGIBER. *Rhizoma of Zingiber officinale, Roscoe in Linn. Trans.* viii.—*Spr.* (Edin. Lond.) *Root of Amomum Zingiber, Linn.* (Dub.) *Ginger.*

SYRUPUS ZINGIBERIS.

PROCESS, *Edin. Lond. Dub.* Take of Ginger, two ounces and a half (four ounces, D.); Boiling water, two pints and a half (three old-wine pints, D.) Bruise (slice, L.) the ginger; infuse it for four (twenty-four, D.) hours in the water; and to the strained liquor add the sugar, and dissolve it (with the aid of heat, E.)

TINCTURA ZINGIBERIS, E. L. D.

PROCESS, *Edin. Lond.* Take of Ginger in coarse powder (sliced, L.), two ounces and a half. Rectified (Proof, L.) spirit, two pints. Proceed by percolation or digestion as directed for tincture of cinchona (*Edin.*) Macerate for 14 days and strain (*Lond*)

PROCESS, *Dub.* Take of Ginger in coarse powder, two ounces; Proof-spirit, two pints, (old wine measure.) Macerate for seven days, and strain.

PULVIS AROMATICUS. See *Cinnamomum*.

FOR. NAMES.—*Fren.* Gingembre.—*Ital.* Zenzero; Zenzevero.—*Span.* and *Port.* Gengibre.—*Ger.* Ingwer.—*Dut.* Gember.—*Swed.* Ingefära.—*Dan.* Ingever. —*Russ.* Imbir beloi.—*Arab.* Zingebeel.—*Pers.* Zungebeel.—*Tam.* Sookoo. —*Hind.* and *Beng.* Sont.—*Sansc.* Sunthi.

FIGURES of Zingiber officinale in Nees von E. 61.—Van Rheede, Hort. Malabar. xi. 12.—St. and Ch. iii. 96.

GINGER has been used immemorially in Eastern Asia, and was known as an aromatic to Dioscorides, by whom the plant is called Ζιγγίβερις, and is said to have grown abundantly in Troglodytic Arabia.

Natural History.—The *Amomum Zingiber* of Linnæus and Willdenow,—now more generally known as the *Zingiber officinale* since the investigations of Roscoe,—belongs to the class and order *Monandria Monogynia* in the sexual arrangement, and to the Natural family *Drymyrrhizeæ* of Decandolle, or *Zingiberaceæ* of Lindley. It is now cultivated in most hot climates throughout the globe; and its original source is not positively known, though generally conceived to have been the East Indies. It has a biennial, or perennial (Nees von Esenbeck), creeping root, which is composed of a tuberous, knotty, lobated or palmated, fleshy rhizoma, and numerous short radicles. From the root proceed several barren, leafy, herbaceous stems about three feet high, and also several independent flowering stems or scapes, without leaves, enveloped in scaly sheaths, scarcely a foot in stature, and terminating in a short, club-like spike of flowers. Its fruit is a trilocular capsule, which is filled with blackish, bitter, aromatic seeds. The plant may be propagated either by seeds, or by cuttings of the root; and the

latter is the method generally followed. The cuttings being planted out in spring, their root-stocks acquire in about three months the size, fleshiness and mild aroma, which fit them for the preparation of the familiar confection called Preserved Ginger. At the end of the year or commencement of the next, when the herb has withered, and before the roots become too woody, they are in the fittest state for yielding the ordinary Ginger of commerce. This is prepared by picking and cleaning the rhizomata, and then either scalding them in boiling water and drying them with artificial heat, or by peeling and drying them in the sunshine without immersion in hot water. In the former mode is said to be obtained the Black-ginger, and in the latter way the White-ginger, of commerce. Some however think these varieties so different from one another that they must be produced by different varieties of the plant (Pereira, &c.)

Ginger is imported into Britain from various quarters, but chiefly from the East and West Indies. Both the Black and White kinds of it have a peculiar odour, and a peculiar, powerful, aromatic, burning taste. They are fibrous and amylaceous in texture, yet also somewhat resinous in fracture near the surface. The black-ginger of commerce has a wrinkled epidermis, a dirty-grayish-brown colour externally, and a somewhat horny appearance within. The white-ginger is evidently destitute of epidermis, and has a pale-grayish-yellow colour, and more amylaceous texture. The latter is most esteemed in trade, partly for its more pleasing colour, but partly too because it is prepared from picked, plump pieces, if not from a superior variety of the root. Sometimes however, white-ginger is of low quality, in consequence of the whiteness having been attained by processes which impair its strength. Ginger may be easily and thoroughly bleached by steeping it for twenty-four hours in a mixture of one part of sulphuric acid and nine of water, and then for two days in a solution of chloride of lime (Trommsdorff). It is also sometimes bleached with fumes of sulphur (Pereira). Both processes lessen its aroma. Whiteness is also sometimes communicated by washing it with a mixture of whiting and water (Brande).——The quality of ginger is to be judged of by its colour, odour, taste, heaviness, and freedom from perforations by insects.

Chemical History.—Ginger readily parts with its acrid aroma both to water, proof-spirit, and rectified-spirit; which accordingly are the menstrua for preparing the officinal *Syrupus* and *Tinctura Zingiberis.* Rectified-spirit answers better for the latter preparation than the proof-spirit enjoined by the London and Dublin Colleges, because the solution is not so apt to become turbid on being kept. According to an analysis by Bucholz, in 1817, confirmed in every material particular by Morrin in 1823, white ginger contains about 3.5 per cent of a soft, very acrid resin, 1.5 of a yellow, acrid, volatile oil, 10.5 acidulous extractive, 12.5 soluble gum, 8.3

bassorin, and 19.75 starch, together with mucilaginous extract, lignin, and other unimportant ingredients. Its starch may be obtained of fine quality and perfectly white, to the amount of more than twenty-five per cent (Ricord), by the ordinary process of elutriation practised in preparing arrow-root.

Actions and Uses.—Ginger is one of the best and most familiar of hot aromatics. In its action it is irritant, and in large quantity might prove poisonous. In moderate doses, it occasions an increased flow of saliva when chewed,—and when swallowed, it acts as a stimulant, tonic, stomachic, and carminative,—augmenting the secretion of gastric juice, probably exalting the excitability of the alimentary muscular system, and dispelling alimentary gases accumulated in the stomach and bowels. From these actions it has enjoyed some reputation as a remedy in gout. It is very much employed as a condiment; for which purpose it is perfectly safe when taken in moderation. In medicine it is seldom used alone, except in domestic practice as a carminative. But no other aromatic is in greater request, either in officinal formulæ or in extempore prescriptions, for disguising other drugs, or taking away their nauseating effect on the stomach, or preventing their tendency to cause tormina. Ginger powder is also at times used in the form of paste as a rubefacient.—Besides the simpler preparations described at the head of this article, there are fifteen officinal compounds in the British Pharmacopœias, of which it forms a part. These are the *Acidum sulphuricum aromaticum*, E. D. *Confectio* or *Electuarium opii*, E. L. D. *Confectio* or *Electuarium scammonii*, L. D. *Infusum sennæ compositum*, L. D. *Pilula gambogiæ composita*, E. L. D. *Pilula scillæ composita*, E. L. D. *Pilula hydrargyri iodidi*, L. *Pulvis scammonii compositus*, L. D. *Pulvis rhei compositus*, E. *Pulvis aloes compositus*, L. D. *Pulvis cinnamomi compositus*, L. *Syrupus rhamni*, E. L. D. *Tinctura cinnamomi composita*, L. *Tinctura rhei composita*, L. *Vinum aloes*, E.—— Ginger is also used for making a variety of articles in current use in the dietetics of medicine, such as ginger-beer, ginger-lozenges, essence of ginger, &c. The last is a strong tincture.

The doses of its simple preparations are *Pulvis zingiberis*, gr. v. ad scr. i. *Syrupus zingiberis*, fl.dr i. ad fl.dr. ii. *Tinctura zingiberis*, fl.dr. i. ad fl.dr. ii.

SUPPLEMENT

CONTAINING

THE MOST IMPORTANT NEW REMEDIES WHICH HAVE COME INTO GENERAL USE SINCE THE PUBLICATION OF THE LAST EDINBURGH PHARMACOPŒIA IN 1841.

ACIDUM GALLICUM. *Gallic Acid.*

Chemical History.—Gallic Acid was discovered by Scheele. It is said to exist largely in the seeds of the mango, and in less proportion in many other astringent vegetables; but in general it does not pre-exist, being formed from tannin by oxidation.

It is obtained from galls either by slow oxidation of their tannin under the influence of atmospheric air and moisture, or more quickly by the oxidating agency of sulphuric acid. The newest process of the former kind is a modification by Müller of the original method of Scheele. Sixteen ounces of blue galls in coarse powder being exhausted by boiling water, the filtered decoctions are exposed to the atmosphere for four months in a covered earthen-ware vessel at a temperature between 100° and 120° F. The impure gallic acid thus formed is then collected on a filter, washed, dried, and re-dissolved in four times its weight of boiling water. As the filtered liquor cools, crystals form, which are re-dissolved in as small a quantity of boiling water as possible, re-crystallized, dried, and digested for several days in three ounces of rectified spirit, along with an ounce of purified animal charcoal. The mixture is then boiled and filtered, and the solution allowed to crystallize after moderate concentration. The crystals, now pale brown, may be rendered colourless by washing them slightly with alcohol, and re-crystallizing them from three times their weight of boiling water. In the first part of this process, the tannin undergoes oxidation at the expense of the atmospheric oxygen, and carbonic acid is

evolved equivalent to the oxygen which disappears (Pelouze). When well managed, the process yields a sixth of the weight of the galls in the form of snow-white gallic acid.——The other process, by means of sulphuric acid, was proposed by Liebig. A concentrated infusion of galls in cold water is precipitated by sulphuric acid, and the pulp is washed with a little diluted sulphuric acid, squeezed, and then boiled with that acid and twice its volume of water; until it ceases to undergo solution. As the liquor cools, crystals of gallic acid form, which are freed of sulphuric acid by re-crystallization. Being again dissolved in boiling water, the acid is thrown down as gallate of lead by the acetate of that metal, and the gallate, well washed, is decomposed in boiling water by hydrosulphuric acid gas. When the liquor cools, crystals of considerable purity are obtained. This process has not hitherto been found a productive one.

Gallic acid assumes the form of delicate rhombic prisms, of a brilliant lustre, without odour, and of a sweetish acid taste, without astringency. It is soluble in three parts of boiling water and one hundred parts at 60°; it is much more soluble in alcohol; but ether dissolves it sparingly. When heated to 212°, it parts with an equivalent of water. At a higher temperature, new acids are formed. It does not precipitate gelatin, like tannic acid, but it resembles it in occasioning a bluish-black precipitate with the salts of iron. The crystals consist of seven equivalents of carbon, one of hydrogen, and three of oxygen, in union with three of water (C^7HO^3+3HO).

The gallic acid of commerce is not at present subject to adulteration. It is prepared in large quantity by Mr Macfarlan of this city, of a very pale yellowish-gray colour, and free of every impurity except a mere trace of colouring matter, which cannot be removed without much loss of material.

Actions and Uses.—Gallic acid has lately come into general use as an internal or constitutional astringent. It has been found serviceable in chronic mucous discharges from the bowels or urinary bladder. But its most remarkable effects as an astringent have been manifested in hæmorrhages, especially from the kidnies, the uterus, and the lungs. I have seen several cases of menorrhagia promptly recover under its use. I have likewise seen hæmaturia repeatedly yield to it. And in two cases of hæmoptysis the hæmorrhage rapidly ceased after the third dose of six grains given every hour. Mr Lyell of Newburgh not long ago turned my attention to its apparent power of arresting the excretion of albumen with the urine in Bright's Disease of the Kidney; and in a few instances it has appeared to me to have this effect.

The usual dose is three grains thrice a day, in the form of pill, made with liquorice-root powder and conserve of red-rose. In urgent cases of hæmoptysis I have given 36 grains in twelve hours.

ARSENICI ET HYDRARGYRI IODIDI LIQUOR. *Solution of Iodide of Arsenic and Mercury. Donovan's Liquid.*

Chemical History.—THIS preparation, which has been introduced by Mr Donovan of Dublin, is intended to combine the powers of the three potent agents,—arsenic, iodine, and mercury. It is prepared in the following manner. Triturate 6.08 grains of finely levigated metallic arsenic, 14.82 grains of mercury, and 49.00 grains of iodine, with a fluidrachm of alcohol, until the mass has become dry, and from deep-brown has become pale-red. Pour on eight fluidounces of distilled water, and after trituration for a few moments transfer the whole to a flask; add half a drachm of hydriodic acid prepared by the acidification of two grains of iodine, and boil for a few moments. When the solution is cold, dilute it, if necessary, so that it shall measure eight fluidounces; finally filter (Donovan).

In this process the proportions of the materials are so adjusted that iodide of arsenic and biniodide of mercury are formed, and when these are boiled in water they combine, forming a double salt in which the biniodide of mercury plays the part of an acid to the iodide of arsenic. From this view of its constitution Soubeiran has called it the iodo-hydrargyrate of arsenic, and has proposed to form it by boiling one part of iodide of arsenic, one part of biniodide of mercury, and 98 parts by weight of water together. By this proceeding a perfect solution is obtained without the necessity for the minute and troublesome weighings required by Mr Donovan's formula.

To insure success in Mr Donovan's process, the materials require to be perfectly pure, and to be thoroughly triturated together. The object of adding the hydriodic acid is to keep in solution a grayish deposit which is apt to pass through the filter and remain long suspended, rendering the fluid turbid. The iodine will be most readily acidified by the action of sulphuretted hydrogen (see *Potassæ hydriodas, D.*)

Donovan's solution when properly prepared is of a pale-yellow colour, which however becomes deeper when it is long kept, but without any deposit forming. It has an acid reaction, no odour, but a styptic metallic taste. Each fluidrachm corresponds in strength to one-eighth of a grain of arsenious acid, one-fourth of a grain of peroxide of mercury, and three-fourths of a grain of iodine.

Actions and Uses.—This preparation has been for some time in general use in those forms of disease which are believed to be benefited by the constitutional action of iodine, mercury, or arsenic. Scaly cutaneous eruptions, constitutional syphilis, and lupus, are the diseases to which it has been most frequently applied. It is seldom pushed so far as to induce the constitutional action of arsenic, but slight mercurial salivation has been several times observed to follow its

use. In strumous lupus its external application as a wash to the sore, conjoined with its internal administration, has appeared to be useful.

The ordinary dose is from five to twenty minims twice or thrice daily. It is best given simply in solution with water, as it is very readily decomposed by other substances.

ARSENICI IODIDUM. *Iodide of Arsenic.*

When one part of pure metallic arsenic is heated with three parts of iodine, combination occurs, and if the heat be prolonged, a substance sublimes in thin orange-red crystalline plates, which are iodide of arsenic. To obtain it in the crystalline form the heat must be moderate, as the iodide is very fusible. The salt may also be prepared in the liquid way by boiling 3 parts of pulverized metallic arsenic and 10 of iodine in 100 of water till all smell of iodine is gone, and then evaporating the filtered fluid rapidly to complete dryness. The iodide of arsenic is a bright brick-red crystalline substance, volatile and readily fusible by gentle heat into a deep blood-red fluid, which on cooling concretes into a deep-red crystalline mass of metallic lustre. It has no smell and a faint metallic taste. It consists of 16.56 per cent of metallic arsenic and 83.44 of iodine; which corresponds to the constitution of AsI^3 (Plisson.) It is soluble in water, forming a pale-yellow solution with a strong acid reaction. If this solution be rapidly evaporated to dryness, the red iodide of arsenic is obtained of its original appearance; but if the watery solution be concentrated and allowed to cool, it deposits white glittering crystals, which are a compound of arsenious acid and iodide of arsenic, whilst the mother liquor contains iodide of arsenic and free hydriodic acid (Soubeiran). It thus appears to be decomposed by water, and is in fact an unstable compound; for even when kept in bottles, if they be frequently opened, it loses iodine in course of time, though without altering in colour (Bette).

The iodide of arsenic has been particularly recommended as a remedy in chronic skin diseases, especially in lepra, psoriasis, and chronic impetigo. When used for ten or twelve days it produces the constitutional effects of arsenic, such as dryness of the throat, epigastric tenderness, diarrhœa, and tormina; but no subsequent bad effects follow its use in properly-regulated doses (A. T. Thomson). There is great doubt whether this preparation has any other action than as a compound of arsenic. The ordinary dose is from one-sixteenth to one-tenth of a grain two or three times daily. It may be given in pill or in simple solution in water.

BEBEERINAE SULPHAS. *Sulphate of Bebeerina.*

The existence of an alkaloidal principle in the bark of a large forest tree of British Guiana, and its application as an antiperiodic to the treatment of the intermittents of that country, were first

pointed out by Dr Rodie, whose observations were made known by Sir Andrew Halliday in 1835. The subject however attracted little notice, until it was more fully investigated by Dr Douglas Maclagan, who in 1843 confirmed Dr Rodie's statement as to the existence of an alkaloid in the bark, and found it to contain two distinct principles, both apparently possessed of basic properties, to one of which he applied Dr Rodie's name of Bebeerina, and to the other that of Sipeerina, from the name given to the tree by the Dutch colonists of Guiana.

Natural and Chemical History.—The tree in question is known in Guiana by the Indian name of Bebeeru, and its timber under the appellation of Greenheart has long been employed in ship-building. It was stated by its discoverer to belong to the laurel tribe; but its further botanical history was unknown, till it was described by Sir Robert Schomburgk in 1844, who referred it to Rottboll's genus *Nectandra* and named it *Nectandra Rodiæi.* It seems not improbable however that a further examination of recent flowers may show it to belong to a distinct genus. It is a magnificent forest tree 60 feet high and upwards, of the Natural family *Lauraceæ*, and of Linnæus's class and order *Dodecandria Monogynia*, inhabiting rocky hill sides in British Guiana, twenty to fifty miles inland, on the borders of rivers. Its trunk is undivided by branches till near the top, and is covered with a smooth ash-grey bark. Its leaves are coriaceous, smooth and shining, nearly opposite, five or six inches long, and two or three broad. It bears axillary panicles of obscure whitish-yellow flowers, succeeded by a globular berry about six inches in circumference, having a woody, grayish-brown, speckled pericarp, and a seed with two large plano-convex cotyledons, which is yellow when fresh cut, and possesses an acid reaction and an intensely bitter taste. The fruit abounds in starch, which is used by the aborigines as food, although it cannot be entirely deprived of its bitter taste (Schomburgk).

The bark as it has hitherto been sent to this country is obviously that of the trunk. It is in flat pieces from one to two feet long, and from two to six inches broad, about four lines thick, heavy, with a rough fibrous fracture, dark cinnamon-brown and rather smooth within, and covered externally with a brittle greyish-brown epidermis. It has little or no aroma, no pungency or acrimony, but a strong persistent bitter taste, with considerable astringency. The sulphate of bebeerina as now employed in medicine is obtained from the bark. The seeds also yield it, but not easily. The amount of sulphate obtained from the bark now in commerce does not exceed $1\frac{1}{2}$ per cent; but it seems probable from the analogy of other barks, that if the bark of the smaller branches were sent instead of that from the trunk, the product would be greater.

The process for obtaining sulphate of bebeerina for medicinal use is essentially the same as that of the Edinburgh Pharmacopœia for sulphate of quina. The bark is first freed of tannin and

colouring matter by boiling it with carbonate of soda, it is then exhausted by boiling in water acidulated with sulphuric acid, and the alkaline matter is thrown down from the concentrated acid liquor by means of carbonate of soda. The impure bases thus separated are washed, dissolved and neutralized with weak sulphuric acid, and the solution is treated with animal charcoal, concentrated, filtered again, and finally evaporated in thin layers in flat vessels. Any excess of acid must be carefully avoided, otherwise the salt will be charred on evaporating it to dryness. None of the salts of bebeerina are crystallizable.

The sulphate of bebeerina of the shops, contains both bebeerina and the so called sipeerina. It occurs in thin somewhat glittering scales of a brownish-yellow colour, and forming a yellow powder. It is soluble in cold water, but the solution is usually turbid, apparently in part from a slight excess of base in its constitution, and partly from the sipeerina having a tendency to alter and become insoluble. The addition of a few drops of diluted sulphuric acid renders its solution more complete. It is also soluble in spirit. Its taste is intensely bitter, more persistently so than that of the sulphate of quina, and with a slight astringency. If well prepared the scale-like particles should be glittering and translucent, and ought when incinerated to leave no ash or a mere trace only. In this way, sulphate of lime, the only important impurity which has been found in it, may be easily detected. It contains when carefully dried 90.83 per cent of base, and 9.17 of sulphuric acid (Maclagan).

Pure bebeerina may be got from this commercial salt in the following manner. The sulphate being decomposed by ammonia, the precipitated bases are carefully washed with cold water, and while still moist are triturated with moist hydrated oxide of lead. The magma is then dried on the vapour bath, and subsequently exhausted with rectified spirit, which dissolves the alkaloids, leaving any tannin and other impurity united with the oxide of lead. The alcohol is distilled off, and the yellow resinous-looking mass which remains is treated with pure ether, which dissolves bebeerina, leaving the sipeerina behind. The latter has not been examined. It appears to be an alkaloid, but is a rather unstable substance. Bebeerina, as obtained in thin scales by the evaporation of its ethereal solution, is of a bright canary yellow colour, but when in powder appears nearly white. It dissolves in acids and neutralizes them, forming yellow salts, which no attempt yet made has succeeded in obtaining in the colourless or crystalline condition. Its constitution is identical with that of morphia, being $C^{35} H^{20} O^{6} N$ (Maclagan and Tilley.)

Action and Uses.—The action of bebeerina is essentially that of a tonic and antiperiodic, and the forms of disease to which it is applicable are the same in kind as those for which quina is employed. It increases the appetite, improves the tone of the consti-

tution generally, and raises the pulse a little, but has not so great a tendency as quina to produce ringing in the ears, headache, vertigo, and other symptoms of affection of the nervous system, although it occasionally gives rise to these when administered in large or frequently repeated doses. It was first used in the form of a very impure solution by Dr Rodie in the intermittents of Guiana; and the subsequent trials of it by Dr Watt in Demerara, and by army surgeons in the East Indies, leave no doubt that it possesses decided febrifuge qualities. But some practitioners having reported unfavourably of it in the intermittent and remittent fevers of hot climates, further trials are required to ascertain whether it can be trusted to in such cases. What is known regarding it seems to show, that though not equal to sulphate of quina as a febrifuge, it is a valuable substitute for that drug, when it cannot be procured in sufficient quantity, at a reasonable price.

In many forms of disease prevalent in this country its efficacy is undoubted. Periodic headache and other periodic neuralgias readily yield to it. It appears to be specially applicable to persons of a strumous or phthisical habit, and has been found useful in the latter stages of phthisis to counteract general debility and want of appetite, and check nocturnal perspiration. By many oculists it has been found an effectual substitute for quina in strumous ophthalmia. In atonic dyspepsia and states of debility generally it has come into common use, and it has found especial favour with many accoucheurs in cases of pregnancy requiring tonic treatment. For all these purposes it has come into general employment in this city, and other places in Britain. The dose of sulphate of bebeerina is from one to three grains repeatedly as a tonic, and from five grains to a scruple as a febrifuge. It may be given in pill with conserve of roses, or in solution. For general tonic purposes a good form is half a drachm of the sulphate, twenty-five minims of diluted sulphuric acid, an ounce of syrup, and as much tincture of orange-peel, with four ounces of water. The dose is a tablespoonful thrice a-day.

CALCIS AQUA EFFERVESCENS. *Carrara Water.*

Carbonate of lime is moderately soluble in water containing an excess of carbonic acid. In this state it exists in most springs, and confers their characteristic properties on some calcareous mineral waters. Advantage has been taken of its solubility to prepare an effervescing water similar to the soda, potash, and magnesia waters, lime being substituted for these bases. A preparation of the kind has come into common use under the name of Maugham's Patented Carrara Water. This name seems to imply that pure white marble is used in its preparation; but freshly precipitated carbonate of lime in the gelatinous state is more readily dissolved on forcing carbo-

nic acid gas into the fluid. The carrara water is sold in long cylindrical bottles containing about eight fluidounces. It has all the general properties of the other effervescing waters. It deposits carbonate of lime slowly when exposed to the air, and readily when boiled. It appears to contain about half a grain of carbonate of lime in each fluidounce, and is strongly charged with carbonic acid.

The carrara water may be used for all the purposes to which potash or soda water is applicable. It is a good antacid in virtue of its lime, whilst its carbonic acid renders it gently stimulant to the stomach. It has been preferred by many practitioners to other effervescing waters in atonic dyspepsia and gout, and appears particularly applicable to cases of disease where there is a tendency to diarrhœa.

A wine glassful from time to time may be taken to relieve thirst in febrile affections.

To enable patients to use effervescing waters in quantities less than a bottleful, it is convenient to have a cork-screw with a hollow stem, to which is appended a lateral nozzle furnished with a stopcock. The bottle is tapped by passing the screw down through the cork, and the water can thus be drawn off in small quantities at a time, without the remainder losing its excess of carbonic acid. Maugham's bottles have sometimes an apparatus of this kind fitted to them.

CANNABIS. *Herb of Cannabis Indica, Lamarck. Indian Hemp.*

This plant promises to be an important article of the Materia Medica. Those in this country who have found it inert must blame the preparation they used.

The Greek physicians were not acquainted with its remarkable narcotic properties; for, though Dioscorides says the expressed juice of the seed allays ear-ache when dropped into the ear, he takes no notice of the employment of the herb itself as an internal remedy. The Hindoos were conversant with its virtues so early as the year 600; and the Persians not long afterwards, as well as the Arabians at a subsequent period, employed it as a sedative and anodyne in diseases, and also to excite intoxication. In Europe, although repeatedly mentioned by naturalists and travellers during the last two centuries, it did not come into use in medical practice till Dr O'Shaughnessey of Calcutta published a precise account of its virtues in 1839.

Natural History.—The *Cannabis Indica,* first established as a species by Lamarck, belongs to the Natural Family *Urticaceæ* of Lindley and other botanists, and to the Linnæan class and order, *Diæcia Pentandria.* The external characters which separate it from the *Cannabis sativa, L. W.*, or common hemp of Europe, are

not satisfactory; and good authorities regard the two plants as mere varieties of one species, modified slightly by climate. The Indian plant is a herbaceous annual, three or four feet in height. The leaves are covered with a resinoid varnish, and have a peculiar rather heavy odour. The stem-bark consists of long tough fibres, in universal use for making cordage. The seeds contain a fixed oil, which is inert. The European plant has no resinous varnish on its leaves, but presents scarcely any other distinction from that of India.

Various drugs obtained from Indian hemp are met with in Eastern trade. The *Haschisch* of the Arabs consists of the tops and tender parts only of the plant, collected immediately after inflorescence, and simply dried (Steeze, in Buchner's Repert. xxxvii. ii.) The *Bhang* of the East-Indies is composed of the dried larger leaves and capsules (O'Shaughnessy on Indian Hemp, 1839). *Gunjah* is the whole herb dried after flowering, without removal of its resin; and is usually made up in bundles two feet long and three inches in diameter. *Churrus* is a resinoid substance said to be obtained from the growing plant, either by removing the resinous varnish from the leaves with the hand, or more generally by making men, clothed in leather, brush briskly through the hemp-fields, and then scraping the resin from their dress (Ibidem). Other drugs, sold in the East for smoking or swallowing, are prepared from these by artificial processes. The only articles familiarly known in this country are the Gunjah and Churrus of India, and latterly a superior alcoholic extract prepared from the herb at Calcutta, and now also manufactured in London.

Gunjah, as sent to me by Dr O'Shaughnessy, consists of the stems, leafstalks, and leaves, carefully dried, and the latter crushed into long, narrow, grayish-green masses somewhat of the size and form of the fingers. It has a faint, peculiar, heavy odour, and a corresponding taste, feeble, and mingled with slight bitterness. Churrus, as obtained from the same source, is in roundish masses, towards the size of a hen's egg, grayish-yellow, friable, of the same odour and taste as gunjah, but stronger, and by no means a pure resin, but obviously consisting of a large proportion of fine fragments and dust of the plant. The sensible and active properties of both these articles are said to be much impaired by time; and in this way their apparent inactivity in European practice is thought to be accounted for.

Chemical History.—Indian hemp has not yet been subjected to a careful proximate analysis. The dried herb does not part with its properties to water. Even proof-spirit is a feeble solvent; but rectified-spirit dissolves its active part with facility. Oils and fats aided by heat, seem also good solvents; at least heated butter is the menstruum for preparing the basis of a familiar preparation in India, a sort of confection called there *Majoon.* The alcoholic solution yields an active extract in the usual way. The best prepa-

ration yet used in this country is an alcoholic extract prepared by Mr Andrew Robertson of Calcutta, by forcing the steam of rectified-spirit downwards through the dried herb contained in a cask, and distilling off the alcohol from the tincture which trickles from the condenser at the bottom. Gunjah yields about a fourteenth of its weight of this extract. As sent to me by Mr Robertson, it is resinoid, green when spread out, of a strong hemp odour and taste, and of undoubted activity, which it has retained without apparent diminution for two years. The usual form in which it is employed in this city is that of tincture made with an ounce of extract and twenty fluidounces of rectified-spirit. I have also used it in the forms of pill and emulsion. The active constituent of Indian hemp is either a resin, or a principle hitherto inseparably united to a resin. Schlesinger obtained from European hemp a number of unimportant inert principles and five per cent of a bitterish somewhat acrid resin. The Messrs Smith, druggists, of this city, satisfied themselves that the resin obtained from Indian hemp concentrates in itself the whole properties of the plant; and they give the following process for preparing it. Digest bruised gunjah in successive portions of warm water till the expressed water comes away colourless; and again for two days at a moderate heat in a solution of carbonate of soda, in the proportion of one part of salt to two of gunjah. Colouring matter, chlorophyll, and inert concrete oil being thus removed, express and wash the residuum, dry it, and exhaust it by percolation with rectified-spirit. Agitate with the tincture milk of lime containing an ounce of lime for every pound of gunjah; and after filtration throw down excess of lime with a little sulphuric acid. Agitate with the filtered liquor a little animal charcoal, which is afterwards to be removed by filtration. Distil off most of the spirit, add to the residual tincture twice its weight of water in a porcelain basin, and let the remaining spirit evaporate gradually. Lastly, wash the resin with fresh water till it comes away neither acid nor bitter; and dry the resin in thin layers. This resin retains the peculiar taste and odour of the gunjah. A temperature of 180° F., acting for eight hours on thin layers of it exposed to the air does not impair its activity. It is readily dissolved by rectified-spirit. Dry gunjah yields six or seven per cent of it; and its strength as a narcotic corresponds with this proportion.

Actions and Uses.—Numerous observers have described Indian hemp as producing in the natives of the East, who familiarly use it instead of intoxicating spirits, sometimes a heavy, lazy state of agreeable reverie, from which the individual may be easily roused to discharge any simple duty,—sometimes a cheerful, active state of inebriation causing him to dance, sing, and laugh, provoking the venereal appetite, and increasing the desire for food,—and sometimes a quarrelsome drunkenness, leading to acts of violence. During this condition, pain is assuaged and spasm arrested. Sleep

usually supervenes in three hours; and when this passes off, no nausea, loss of appetite, or constipation follows; no other symptom but slight vertigo. The frequent use of it, however, brutalizes the intellect. On trying Mr Robertson's extract once for toothache, I found that about four grains taken at 3 A. M. caused in an hour cessation of pain, a pleasant numbness in the limbs, giddiness, a rapid succession of unassociated ideas and impossibility to follow a train of thought, frequent intervals of sleep, and slight increase in the force of the pulse. Next morning there was an ordinary appetite, much torpidity, great defect and shortness of memory, extreme apparent protraction of time, but no peculiarity of articulation or other effect; and these symptoms lasted till 2 P. M., when they ceased entirely in a few minutes after taking lemonade. In some instances a condition like catalepsy has been produced, in others a state resembling delirium tremens. In my own professional experience it has produced sleep, relieved pain, and arrested spasm; and I have never observed any disagreeable effect during or after its action, except that in one instance it excited, as its operation commenced, an alarming sense of occasional succussions in the brain. Dr O'Shaughnessy found that carnivorous animals were easily intoxicated by it, but that graminivorous animals were affected with greater difficulty. No inquiry has yet been made on the effects of large doses.——The hemp grown in Europe is thought to be inert, and as its leaves are not varnished with resin, it is probably feeble compared with the Indian plant; but the only careful experiments with it which I have seen detailed, those of Parent-Duchatelet, are not at all conclusive (Ann. d'Hyg. publ. 1832).

Indian hemp has been used as an antispasmodic in hydrophobia, tetanus, malignant cholera, and infantile convulsions, with marked relief in repeated instances. Some cases of tetanus appear to have been cured in the East-Indies by it; favourable cases have been reported also in this country; and my colleague, Professor Miller, had a case under his care which proved successful without any other important remedy. It has also been employed with success as an anodyne in chronic rheumatism, toothache, and other varieties of neuralgia. I have used it a good deal, and with decided success, in diseases at large, to obtain sleep. On the whole, it is a remedy which deserves a more extensive inquiry than any hitherto instituted.

The dose of the alcoholic extract is from two to five grains, as a hypnotic, anodyne, and antispasmodic. On account of its insolubility it should be given either in the form of emulsion, or in that of tincture dropped into water immediately before administration. An emulsion may be made by triturating five grains in a warm mortar with fifteen minims of olive-oil, and then adding gradually a fluidrachm of mucilage and two fluidounces of water (Bromfield). ——The tincture of the extract, dispensed by the Edinburgh drug-

gists, is given, in a dose varying from fifteen to forty drops, with a little, water, sometimes sweetened with sugar. The pure resin of Messrs Smith appeared to them to be very active in the dose of two-thirds of a grain, though made from old gunjah.

CHLOROFORMUM. *Chloroform. Terchloride of Formyl.*

CHLOROFORM was discovered in 1832 almost simultaneously by Soubeiran and by Liebig. In 1835 Dumas first successfuly investigated its composition and relations to other bodies. Dr Mortimer Glover in 1842, and Flourens in March 1847, first ascertained its action on animals. And in November of the same year Dr Simpson discovered and applied its most remarkable properties as an anæsthetic agent in delivery, in surgical operations, and in various diseases.

Chemical History.—It was first obtained by the action of alkalis on chloral. But it is now prepared more cheaply and easily by the action of bleaching powder on either alcohol or pyroxylic spirit. The most fragrant chloroform is obtained with alcohol. One pound avoirdupois of bleaching powder, with three pounds of water and three ounces of rectified-spirit, yields, by distillation in a roomy vessel, about nine fluidrachms of crude chloroform of the density 1220. After this the residuum begins suddenly to froth up. The crude chloroform, which is covered in the receiver by a stratum of weak spirit, is purified by shaking with it half its volume of sulphuric acid gradually added; and water and alcohol being thus removed, the strong chloroform is freed of a little sulphuric acid by redistilling it from milk of lime or baryta. The product, which is pure chloroform, if the process be well conducted, amounts to about half a fluidounce. I have not found the quantity to be increased, as some have represented, by increasing the alcohol.

It is a transparent, colourless, mobile, heavy fluid, of the density 1480 at least, of a peculiar, fragrant, etherial, apple-like odour, and of a corresponding etherial, slightly acrid, intensely sweet taste. A globule presents singular alterations of form under the influence of diluted acids and alkalis, though no chemical change ensues (Dr George Wilson). It quickly evaporates in the air, and it boils at 140° F. It does not burn, and it communicates a dull, yellow, sooty flame to burning alcohol. It is readily soluble in alcohol and ether, but only in 2000 parts of water; to which however it imparts its strong peculiar odour. It dissolves volatile oils, camphor, caoutchouc, wax and resins. According to Liebig it also dissolves sulphur and phosphorus; but Mr Alfred Taylor denies this. Strong sulphuric acid has no action on it in the cold. Alkaline solutions boiled long with it convert it into chloride of the metalloid and formiate of the alkali. It consists, according to Dumas, of three equivalents of chlorine united with two of carbon and one of hydrogen, that is, with one equivalent of Formyl, the compound

radicle of formic acid (C^2HCl^3, or $Fo\dot{C}l^3$). It is therefore the Terchloride of Formyl.

Adulterations.—It is often adulterated. The most frequent impurity is alcohol. This is easily detected by the density being more or less reduced, or by its drops becoming opaline when dropped into water. It may also contain, through faulty preparation, a trace of sulphuric acid; which may be discovered by litmus-paper, or the action of nitrate of baryta on distilled water agitated with it. Other compounds of hydro-carbon are probably also sometimes present; but this branch of the subject has not been studied, although it will probably explain the occasional anomalous effects observed in medical practice.

Actions and Uses.—Chloroform is in large doses a narcotic poison, and in medicinal doses a stimulant, sedative, antispasmodic, anodyne, and anæsthetic. Irritant effects have also been observed; but these are inconsiderable, when it is pure.

In large doses, it occasions a state of deep coma, which may prove fatal. In such cases convulsions are not common. For the most part no marked direct influence is exerted on the heart; for in animals immediately after death the blood is found dark in its left cavities, showing that it had continued to beat after cessation of the breathing. Nevertheless in certain unascertained constitutional circumstances, excessive depression of the heart's action is apt to be produced in man. I have not myself witnessed this. But Dr Dewar of Torryburn informs me, that he once observed prolonged deliquium and an excessively feeble pulse produced by the inhalation of an ordinary dose; so that powerful stimulants were required for three-quarters of an hour, and he was for some time apprehensive of the result. Two fatal cases have occurred in the human subject, one from an ordinary dose, the other from a larger quantity. The immediate pathological cause of death in these instances is obscure; but both are very extraordinary, when it is considered that many thousand trials must now have been made on man without any serious accident or inconvenience. In both the lungs were much congested, and in one affected with patches of pulmonary apoplexy; appearances which have been also witnessed in animals.

When taken internally in medicinal doses, chloroform acts as a calmative and antispasmodic. So early as 1838 Dr Formby of Liverpool used it on account of these properties in hysteria; and in 1844 M. Guillot of Paris made use of it as an antispasmodic in asthma. No great attention however has been since paid to its actions and uses when given in this manner, although there can be little doubt that it will prove an important remedy. It seems to be serviceable for arresting chronic vomiting from nervous causes, such as that which occurs in pregnancy.

When inhaled in the dose of twenty or thirty minims from a handkerchief, it speedily occasions whizzing and pulsation in the

head, a change in the apparent colour of objects, pleasurable ideas and visions, loss of consciousness or a semi-conscious state, and either soft sleep, or tendency to laughter and jocularity, or propensity to incoherent talking, or boisterous turbulence. And when this state passes off, which happens in five or six minutes at most, there is little or no recollection of what has passed, and no remembrance of pain, even although pain may have been expressed. These phenomena closely resemble in nature and variety the effects of the inhalation of nitrous oxide gas. The effect on the heart's action is variable. The most frequent deviation I have observed is some increase in the frequency, and diminution in the force, of the pulse; but often no distinct change takes place; and occasionally the pulse is strengthened.

When a dose of one fluidrachm, or somewhat more, is inhaled in the same way, the most frequent effect is the rapid production of coma, with complete relaxation of the muscles, slow and often stertorous breathing, upturning and fixing of the eyes, and total insensibility to agents which cause in ordinary circumstances the most acute suffering. The pupils are variously affected, but always contractile. Some frothing at the mouth is not unusual. Slight convulsive twitches of the face or limbs are more rare. The insensibility may begin in fifteen seconds,—and is seldom postponed beyond two minutes, if the chloroform be skilfully applied. It continues usually between five and ten minutes, but sometimes for two hours, if the inhalation has been kept up for some time by renewing the chloroform on the handkerchief. Sometimes quiet sleep succeeds, more generally a drowsy dreamy state, but not unfrequently rapid complete consciousness and activity. In general no recollection whatever is retained of any occurrence during the state of insensibility, but sometimes there seems a dim apprehension of what passed. For the most part there is no remarkable subsequent effect, no lassitude, no headache, no sickness, no loss of appetite; occasionally however a little weariness or sickness.

Other results have also been observed, but so seldom that they must be considered anomalies, depending on constitutional peculiarities, or impurities in the chloroform. I have witnessed violent tetanic spasm twice in the healthy state and once in delirium tremens, but without any ill consequence; hysteric agitation, contortions, and screaming have also been witnessed, also without any ultimate harm; and during both of these affections there has been no recollection afterwards of any uneasiness. Sickness and vomiting have sometimes occurred, chiefly, according to my observation, when the remedy was used too continuously, so as greatly to obstruct the breathing. Relaxation of the sphincters is an untoward incident, which is not so frequent as might be expected. The only really formidable affection is sinking of the pulse, as in the case adverted to above; and this seems a rare occurrence.

The special uses of chloroform are numerous. It has been sub-

stituted for the inhalation of sulphuric ether, to induce insensibility during surgical operations. For this purpose it has the advantage over ether of being much more rapid in its action and more certain, of acting in a much less dose, of requiring no nicer apparatus than a handkerchief, and consequently of being applicable in some circumstances, such as in operations near the mouth, and in almost all operations on children, in which ether can scarcely be made available at all. Since its first recommendation by Dr Simpson, it has been extensively used in this city in the way of inhalation to subdue the sufferings of child-bearing. Its effect is perfect, and may be maintained uninterruptedly for many hours, without influencing the frequency or force of the uterine contractions, and without any eventual harm. It is only when the deepest coma, with suffocative stertor, is brought on, that the uterine contractions are apt to be arrested for a time; a property which may be taken advantage of to facilitate the operation of turning. I have used it with great advantage in the same manner to arrest hiccup, even during fatal peritonitis, and to put an end to the paroxysm of tic douloureux. Others have found it efficacious in asthma, hysteria, chronic vomiting, and delirium tremens. It has also been found of service occasionally as a hypnotic in the noisy forms of chronic insanity; and as a temporary measure it has proved most serviceable in the removal of obstreperous lunatics from one place to another.

It will probably be found to serve for some of these purposes equally well when taken internally.

The dose for inhalation is a fluidrachm at a time; which must be renewed in two minutes if the desired effect be not induced. There seems no limit to the safe repetition of it. Dr Simpson has used eight fluidounces in thirteen hours in a case of labour. The patient experiences least annoyance, and is least apt to show a precursory stage of excitement, when a full dose is used at once. Innumerable chloroform inhalers have been contrived in London and Paris; but nothing is so convenient as a small muslin or silk handkerchief loosely twisted into the form of a bird's nest; no other apparatus is used in Edinburgh; and no inhaler can be more efficacious. When the effect produced is too intense, the best remedies are the horizontal posture, cold air fanned across the face, and a stream of cold water poured on the brow and head only. Ammonia may be inhaled also; but internal stimulants should not be given till the patient revives in some measure, otherwise the respiration may be further embarrassed. In urgent circumstances artificial respiration must be promptly added to these means. ——The dose internally is probably from five to twenty minims. It may be given dissolved in water with the aid of a little spirit.

FERRI AMMONIO-CITRAS. *Citrate of Ammonia and Iron.*

FERRI AMMONIO-TARTRAS. *Tartrate of Ammonia and Iron.*

FERRI CITRAS. *Citrate of Iron.*

FERRI LACTAS. *Lactate of Iron.*

NOT satisfied with the multitude of chalybeate remedies already in the Pharmacopœias, medical men and chemists have attempted lately to introduce into practice other preparations of iron; among which the most important are the four compounds placed at the head of this article.

The TARTRATE OF AMMONIA AND IRON possesses the advantages of the officinal tartrate of potash and iron, and is thought preferable to that compound in as much as it is more stable. A good formula for obtaining it is that of Mr Procter of Philadelphia. One hundred drachms of tartaric acid being dissolved in a gallon of water, add gradually $39\frac{1}{3}$ drachms of sesquicarbonate of ammonia that has not effloresced. Dissolve also $53\frac{1}{3}$ drachms of sesquioxide of iron in 180 drachms of hydrochloric acid, dilute the solution with six pints of water, and precipitate the hydrated sesquioxide of iron with an excess of ammonia. When the precipitate has been well washed and collected by means of a filter, add to it the solution of tartrate of ammonia, together with the crystals which form in it; and having dissolved the oxide with the aid of a vapour-bath heat, evaporate the solution to dryness without boiling. The salt is obtained in brownish-black, brilliant, metallic-looking scales, which are garnet-red by transmitted light, rusty-brown in powder, of a sweet, feebly ferruginous taste, and entirely soluble in about their own weight of water. The watery solution is stable. The constitution of the salt is supposed to be one equivalent of neutral tartrate of ammonia, one of basic tartrate of sesquioxide of iron, and four of water of crystallization ($\bar{T}\ N\ H^3 + \bar{T}\ Fe^2\ O^3 + 4\ Aq.$).—Its dose is from one to five grains.

The CITRATE OF IRON, which was first recommended by M. Béral, is prepared according to his formula, by adding to a solution of four ounces of citric acid in the same quantity of water about eight ounces of hydrated sesquioxide of iron in the moist state, or a little more than the acid will dissolve, and favouring the action with a moderate heat; after which the solution is filtered when cold, and allowed to dry up spontaneously spread out upon glass. As it dries it separates from the glass in thin scales, which are garnet red by transmitted light, of an acid, not unpleasant, and scarcely chalybeate taste, and sparingly soluble in cold water, but readily soluble at 212°. This preparation is considered a bicitrate of sesquioxide of iron (Hemingway). Its constitution however seems to be 170 parts of acid and 80 of oxide, that is $2\ \bar{T} + Fe^2\ O^3$.—Its dose is from one to three grains, and it is usually given in the form of pill. Messrs Bewley and Evans of Dublin have introduced into practice

a very agreeable form of the citrate of iron, the salt being dissolved in water surcharged with carbonic acid, and aromatised with syrup of orange-peel. This effervescing chalybeate contains thirteen grains of citrate of iron in each bottle (Apjohn). It is agreeable to the taste, and keeps well. I apprehend however that the salt is originally the citrate of the protoxide, because the solution at first is almost colourless, but becomes yellow and somewhat turbid when exposed to the air. Its dose is one or two fluidounces.

The Citrate of ammonia and iron, also first introduced into practice by Béral, is prepared by adding to the warm solution of citrate of sesquioxide of iron, prepared as above, as much ammonia as will render it neutral to litmus. The solution contains a much more soluble salt than the simple citrate; and it may be obtained in a stable condition in the same way as the corresponding salt of tartaric acid, which it closely resembles in all its external characters and properties. It seems from the analysis of Mr Hemingway to consist of $\bar{C}\,H^3\,N + \bar{\bar{C}}\,Fe^2\,O^3$ + Aq. (undetermined).

Proceeding from the theory that the iron contained in the blood exists in the form of lactate, some have thought that the fittest of all chalybeates for medicinal use is the Lactate of iron. This salt has accordingly enjoyed for a few years past a high reputation as a tonic. Many processes have been proposed for obtaining it. The simplest seems to be the following method suggested by Wöhler. Sprinkle in two pounds of sour whey an ounce of sugar of milk, and the same quantity of pure iron-filings. Digest at a temperature of 100° F. until the sugar be dissolved, and then add another portion of sugar of milk. As soon as a whitish crystalline powder begins to form, the solution is strongly enough charged with lactate of iron. Then boil and filter into a close vessel; and the salt is partly deposited on cooling in greenish-white prisms, and partly forms a crystalline crust. These crystals, when slightly washed with cold water and quickly dried with bibulous paper, are pure enough for medical purposes; and they may be obtained quite pure by a second crystallization. Lactate of iron, when pure, is colourless; but the salt of the shops has a pale grayish-green colour. It has a feebly chalybeate taste. It is sparingly soluble in water. It is a salt of the protoxide of iron, consisting of one equivalent of acid, one of oxide, and three of water of crystallization ($\bar{L} + FeO + 3$ Aq.).—Bouillaud and Fouquier, the Reporters of the French Academy of Medicine on the paper of MM. Gelis and Conté, who first proposed the lactate of iron as a medicinal chalybeate, give a very favourable opinion of it as a tonic in chlorosis and anæmia. It is too costly to come into general use. Its dose is from one to three grains.

MATICA. *Leaves of Piper angustifolium, Ruiz and Pavon. Matico.*

The term Matico seems to be applied in Peru to the leaves of various plants. The matico which has recently been introduced into the Materia Medica of this country by Dr Jeffreys (1839) consists of the leaves and unripe fruit of a piperaceous plant, the *Piper angustifolium* of Ruiz and Pavon, *Stephensia elongata* of Kunth, or *Antarthe elongata* of Miquel.

It has a strong rather fragrant odour, not unlike that of cubebs, and a warm, aromatic, somewhat feebly astringent taste. The leaves are thickly covered with hairs on their posterior surface. They contain a volatile oil, a resinoid matter, and a little tannin. They impart to water their aroma and a slight pungency, but no astringency. The infusion yields a gray precipitate with infusion of galls, and a deep green one with sesquichloride of iron; but tartar-emetic, corrosive sublimate and gelatin scarcely affect it, so that very little tannin can be present.

Matico was strongly recommended as an astringent application for checking hæmorrhage from leech-bites, from the nostrils or gums, and from wounds when the source of loss of blood is a number of small open vessels. For these purposes it really appears a serviceable and convenient remedy. It has been found that the back of the leaf is the most active part. This circumstance, together with the insignificant proportion of tannin contained in it, tends to show that its styptic action is a mechanical one depending on its structure, and not constitutional depending on an astringent principle. Hence the astringent properties ascribed to its infusion and tincture, when given internally, in passive menorrhagia, hæmorrhois and epistaxis, are of very doubtful existence. It may be of service however as an internal remedy in chronic mucous discharges; and indeed it is said to be used by the Peruvians for the same purposes as cubeb-pepper in India.

The forms for internal use are *Infusum Maticæ*, made with an ounce of matico to a pint of boiling water, and *Tinctura Maticæ* made with three ounces to a pint of proof-spirit. The dose of the former preparation is one fluidounce, of the latter a fluidrachm.

MORRHUAE OLEUM. *Fixed oil from the Liver of Morrhua vulgaris, and other fishes. Cod-liver oil.*

The oil obtained from the liver of the cod, ling, tusk, skate, and other species of white fish, has long been a domestic panacea in strumous diseases and chronic rheumatism. Percival in 1782, Bardsley in 1807, and afterwards Scherer in 1822, strongly recommended it for the latter disease. Subsequently it has come into general use in Germany for a variety of purposes; and in this country it has also gradually gained upon the confidence of the profession since the publication of a treatise on its uses by Dr Bennett in 1841.

Cod-liver oil was at one time principally prepared in Newfoundland from the liver of the *Gadus Morrhua* of Linnæus or *Mor-*

rhua vulgaris of succeeding naturalists, by allowing it to drain from the livers as they underwent corruption in the sunshine. Latterly however it has been obtained also from other species of the genus *Gadus*, as well as from the genus *Raia*, especially the *R. clavata* or *R. Batis*, the skate. The oil at first employed was rancid and repulsive to the taste; but a superior sort is now obtained from fresh livers by ebullition with water. This is the mode in which cod-liver oil is prepared by the fishermen of Newhaven for medical use in Edinburgh.

Several varieties of it have been distinguished, especially on the continent, differing from one another chiefly in the depth of their colour, and their more or less rancid taste. The darkest and most disagreeable has been thought by some the most efficacious. But the slowness and uncertainty of the action of every kind, render it extremely difficult to determine which is the best; and there is no good evidence that any other sort is better than the comparatively bland pale golden-coloured oil which is commonly employed in this quarter. The very purest has a heavy odour of fish-oil, and a corresponding nauseous taste. But it is singular how soon in general patients, and even children, become accustomed to it, so as to swallow it without repugnance.

Cod-liver oil consists chiefly, like other fixed oils, of oleïc and margaric acids in union with glycerin, together with small proportions of resinous matter, phosphoric acid, and iodine and bromine. Some have ascribed its medicinal virtues to its iodine. But the proportion of this substance existing in the oil is much too small to account for its action. Wackenroder obtained only from 3 to 6 grains in 10,000 from different kinds of cod-liver oil. Girardin and Preisser got only one grain and a-half from 10,000 of cod-liver oil, and nearly two grains from the oil of the skate's liver; and Yough obtained between three and four grains, and not more from the dark than from the pale sort.

Action and Uses.—This remedy was first used empirically, and no valid explanation of its virtues has been yet given. It is apt to cause sickness at first with some people, and a few are also liable to suffer diarrhœa. But in general it produces neither of these effects. It acts as an alterative, improving the complexion, and tending remarkably to increase the deposition of fat in the cellular tissue. During this change strumous ulcers and enlargement of the glands, strumous ophthalmia, pseudo syphilis, as it presents itself in scrofulous constitutions, various chronic cutaneous diseases, and chronic rheumatism frequently disappear; chronic diseases of the joints are also sometimes benefited; phthisis pulmonalis often undergoes mitigation, and even apparent cures have been reported. Gout, rachitis, caries, and tabes mesenterica are also said to have yielded to it. Its efficacy in many of these obstinate diseases has been exaggerated by its admirers. But there is no doubt that it is occasionally serviceable,

and especially in strumous affections of all sorts. It undergoes digestion; for when two, three or even four ounces daily are taken for months continuously, very little increase is observed by analysis in the oily ingredients of the excretions.

The usual dose is half an ounce twice a-day, which those who can bear a larger quantity may increase to twice as much. But it is right to begin with small doses of a tea-spoonful only, in order to lessen the risk of nausea and vomiting being produced by mere prejudice and disgust. Those who have had most experience in its use find that the best way to administer it is to give it simply, and afterwards a little sugar and cinnamon powder to remove the after-taste; three or four drops of oil of anise, cinnamon, peppermint, or lemon, dissolved in an ounce of the oil also correct the nauseous taste and tendency to cause sickness; but no form of emulsion is any improvement (Bennett).

QUINA AMORPHA. *Amorphous Quinine. Chinoidine.*

WHEN the mother liquors from which sulphate of quina has been crystallized are precipitated by an alkali, a dark-coloured precipitate is obtained, which has long been known to possess the properties of an organic base, and has been termed chinoidine (Sertuerner). In this crude condition, it appears to be a mixture of a brown uncrystallizable organic basic matter, with cinchonia, and traces of quina associated with cinchonic red and tannin. It has been recently examined by Liebig, who finds that its essential constituent is a substance isomeric with quina ($C^{20} H^{12} O^{2} N$), but distinguished by its want of all tendency either in the separate or combined condition to assume the crystalline form. It is commonly prepared by precipitating the mother liquors with ammonia, washing the precipitate with water, dissolving it in spirit, and again precipitating by the addition of water; but it may be readily obtained without the use of spirit. The mother liquors are precipitated by ammonia; the precipitate, which is of a dirty-gray colour, is slightly washed with cold water, and it is then transferred into an open basin containing boiling distilled water. The chinoidine fuses with the heat, and forms a soft, resinous-looking mass, which on cooling assumes the form of a dark-brown brittle solid. In this way it is separated from everything but the slight traces of crystallizable quina which may have remained in the mother liquors; for the cinchonia does not fuse, but remains suspended in the water, while any adhering tannin or cinchonic red is dissolved (Maclagan). It has been supposed to be a product of decomposition, and to result from unskilful manipulation in the process for sulphate of quina; but this does not appear likely; and moreover Dr Maclagan found that in preparing sulphate of quina by three different processes, all varying in productiveness otherwise, the quantity of chinoidine was constantly the same.

When properly prepared, amorphous quina should be a dark-brown brittle mass, completely soluble in alcohol and ether, as well as diluted acids, and forming with the latter bitter solutions, from which it is precipitated by ammonia.

In medicinal qualities, it is stated not to differ essentially from quina. It never however has come much into use in this country. Were its supposed virtues substantiated, it would be important in an economic point of view, and might be more used in the practice of charitable institutions, as its price is much lower than that of the crystallizable variety.

SPIRITUS PYROXYLICUS. *Hydrated Oxide of Methyl. Pyroxylic Spirit. Medicinal Naphtha.*

Pyroxylic spirit, under the incorrect designation of Naphtha, was recommended a few years ago by Dr Hastings as a remedy for pulmonary consumption; and it has come into general use as a palliative for that disease, and also as a powerful anti-emetic drug in cases of obstinate vomiting.

It is obtained in the process of manufacturing wood-vinegar, or pyroligneous acetic acid. According to Dr Ure it is prepared by uniting the crude pyroligneous acid with lime, and then distilling the pyrolignite of lime, which yields about one per cent of crude spirit. The spirit is purified by repeated distillation from quick-lime. It is then a pale straw-yellow, mobile fluid, of a powerful penetrating odour of wood-smoke. Liebig directs it to be farther purified by distilling it on a vapour-bath from chloride of calcium, adding, after the distillation ceases, as much water as there was spirit used, and then continuing the distillation. A little water which is carried over may be removed by re-distillation from quick-lime. It is now a colourless, very mobile liquid, of a peculiar spirituous slightly smoky odour, of a peculiar warm etherial taste, followed by a turnipy after-taste, and highly inflammable. According to Liebig, when quite pure, which it is rendered with difficulty, its density is 804, and it boils at 140° F. But the density of the Edinburgh spirit made in London is so high as 846; and that of the cruder spirit made in Glasgow for burning is about 890. Strong nitric acid has scarcely any action on it. In its solvent properties it closely resembles alcohol; to which also it is analogous in composition. Alcohol being viewed as the hydrated oxide of ethyl (C^4H^5O + Aq.), pyroxylic spirit is the hydrated oxide of methyl (C^2H^3O + Aq.).

Its actions have not yet been carefully investigated; but it seems to be narcotic, sedative, and calmative. It certainly possesses the property of allaying the cough and febrile excitement of phthisis pulmonalis; but general experience has not borne out the sanguine hopes entertained by Dr Hastings of its efficacy as a remedy in that disease. I can amply confirm all that has been said of it as

an anti-emetic remedy in cases of chronic vomiting; for in cases of this affection depending on both functional and organic disease, I have frequently seen the vomiting arrested or greatly mitigated by pyroxylic spirit. Even creasote has appeared to be scarcely so efficacious.

The usual dose is five minims; and it is conveniently given with a drachm of compound tincture of cardamom made into an ounce mixture with water merely.

According to the editor of the Pharmaceutic Journal, the naphtha of Dr Hastings is not Pyroxylic spirit, but Pyro-acetic spirit, Acetone, or Hydrated Oxide of Mesityl of Kane (C^6H^5O + Aq.). But all the so-called Medicinal naphtha of the Edinburgh shops, obtained from London, is Pyroxylic spirit; and this is the substance to which the preceding remarks on the uses of naphtha in diseases must be understood to apply.

SULPHURIS IODIDUM. *Iodide of Sulphur.*

To prepare this compound, four parts of iodine and one of sublimed sulphur are to be triturated together, and then exposed to gentle heat, in a glass or porcelain vessel. The materials become brown throughout, and when this occurs the heat is to be gently raised, the mass brought into complete fusion, and then allowed to solidify by cooling. It is to be preserved in closely-stoppered phials.

In this process iodine and sulphur are used, nearly in the proportion of one atom of iodine to two of sulphur,—the former, from its superior volatility and liability to loss, being in slight excess. They combine directly, forming a compound, which is believed to be represented by the formula S^2I, but which, more probably, is a mixture of more than one combination of iodine and sulphur. As prepared for medicinal use, it occurs in the form of a dark steel-gray striated metallic-looking mass. It is an unstable compound. Heat, alcohol, and solution of iodide of potassium extract iodine from it. It is not soluble in water. It mixes readily with fats, forming a dark-brown ointment.

It is in this form alone that it has been used in medicine. It was introduced by Biett as an external application in chronic cutaneous diseases, especially lepra, psoriasis, and lupus. It has been thought to produce beneficial effects on the tubercles of elephantiasis (Cazenave). It appears to be a good stimulant application, which deserves more attention than it has met with in this country.

It is used as an ointment, in the proportion of one scruple to an ounce of lard or simple cerate.

ZINCI CHLORIDUM. *Chloride of Zinc.*

METALLIC ZINC dissolves readily in diluted hydrochloric acid, evolving hydrogen gas, and forming the chloride of the metal, which

is obtained by evaporating the fluid. As thus got however it is always dark-coloured, from the presence of iron and other metals in the zinc. To obtain the salt pure enough for medicinal use 100 parts of granulated zinc are dissolved in a sufficiency of muriatic acid, 5 parts of nitric acid are added, and the whole is evaporated to dryness. The residuum is redissolved in water, 5 parts of powdered chalk are added, and after resting in contact in the cold for twenty-four hours, the fluid is filtered and again evaporated to dryness (Paris Codex). The object of the latter stages of the process is to get rid of iron. It is peroxidated by the nitric acid, and in this state is separated by the chalk. The product will contain a trifling proportion of chloride of calcium, but not to such an extent as to interfere with its medicinal applications.

Chloride of zinc as thus obtained is in white friable masses. It has no smell, but a sharp saline styptic metallic taste. It dissolves readily in water, alcohol, and ether, and its solutions have an acid reaction. If on dissolving in these menstrua white flocculi separate, it has been overheated and partly converted into a basic chloride. If its watery solution is rendered bluish-black by tincture of galls it contains iron. It is perhaps the most deliquescent salt known, and must be preserved in very accurately ground stoppered bottles.

Chloride of zinc possesses the constitutional actions of the salts of zinc generally, and has been used as a tonic and antispasmodic; but its irritant qualities render it unsafe. Its use now is entirely confined to external application. It is a powerful caustic, acting slowly and deeply, causing much pain and swelling, and producing deep white sloughs, which separate after several days. Its characteristic action as a caustic seems to be its inducing a healthy action on the parts to which it is applied. It has thus been found useful in many intractable sores, especially those forms of ulceration affecting the nose, which are included under the term of Lupus. Cases even of most obstinate character sometimes heal readily under its use locally, conjoined with constitutional treatment by iodine, arsenic, or Donovan's liquid.

From its deliquescent nature it cannot be applied alone, but is made into a paste with two parts of wheat flour. This is allowed to remain on the part for one or two hours. It is then washed off, and a poultice applied.

ZINCI VALERIANAS. *Valerianate of Zinc.*

The Valerianate of Zinc and corresponding salts of Quina and Iron, have of late been introduced by Prince Lucien Bonaparte and others, on the supposition that, with the tonic virtues of their respective bases, they combine the antispasmodic qualities of valerian.

Success in the preparation of these salts depends chiefly on the

value of the methods followed for obtaining the valerianic acid, and this appears to be still an unsettled question among chemists. Valerianate of Zinc may be prepared by the following process. Eight pounds of valerian root are to be steeped for two days in sixty pounds of water, and eighteen pounds distilled off. The distilled fluid is to be redistilled with eight pounds more of the root. The resulting acid liquor is neutralized by milk of lime and concentrated to an eighth. The lime is then thrown down by oxalic acid and any excess of oxalic acid by milk of lime. Freshly made carbonate of zinc is then added to the fluid till effervescence ceases. The filtered solution evaporated yields scaly crystals of valerianate of zinc, which should be skimmed off as the evaporation proceeds, dried between folds of blotting paper, and kept excluded from the air (Gistler). This process would be improved, first by distilling the root from water acidulated with sulphuric acid (Rabourdin), and secondly by exposing the distilled fluid in contact with the lime to the air for some time (Thirault). Probably a more productive process would be to prepare the valerianic acid from the oily matter [hydrated oxyde of amyle] which is separated in the rectification of grain and potatoe spirit. This may be done by distilling the oil from a mixture of caustic potash and lime (Dumas and Stass) or from bichromate of potash and sulphuric acid (Barral).

Valerianate of Zinc is in light pearly crystalline scales of brilliant whiteness, with a very feeble valerianic odour. It is soluble in 50 parts of cold and 40 of hot water, in 16 parts of alcohol, but not in ether (Boudet).

This salt has been much extolled as a tonic antispasmodic of great powers, especially in the treatment of neuralgic affections, in hysterical subjects. It appears to be possessed of considerable virtue in this respect, but hardly to warrant the high commendations bestowed upon it by its panegyrists. It has proved particularly unsuccessful in uterine neuralgia, although it might be expected to be specially applicable to this form of disease. It does not seem liable to produce sickness, and as it is used in doses of from one to three grains it may be conveniently given in the form of pill.

Perhaps its failures may be in part owing to its being frequently ill prepared and adulterated; for it is liable to undergo decomposition, when its solution is exposed to prolonged heat (Leudet) and it appears that in many instances butyrate of zinc has been substituted for it. This fraud is detected by distilling it with diluted sulphuric acid, and testing the acid product with acetate of copper: a bluish-white precipitate is formed with the butyric, but none with valerianic acid (Larocque and Huraut).

INDEX.

ERRATA.

Page 198, 2d line,	*for*	Monadelphia	*read*	Polyadelphia.
... 315, et seq.	...	Bonplandt	...	Bonpland.
... 340, 3d last line,	...	strong,	...	stoney.
... 373, 18th line	...	creazoti	...	creasoti.
... 383, 16th line,	...	Miguel	...	Miquel.
... 405, 4th last line,	...	*Σικυς αγριος*	...	*Σικη αγρια.*
... 776, 45th line,	...	rubefaciant	...	rubefacient.
... 789, 9th last line,	...	*κικιον*	...	*κικινον.*
... 976, 6th line	...	Antarthe	..	Artanthe.

Page 50, 25th line, *insert*

TROCHISCI ACIDI TARTARICI, E.

PROCESS. Take of
Tartaric acid, two drachms;
Pure sugar, eight ounces;
Volatile oil of lemons, ten minims.

Pulverize the sugar and acid, add the oil, mix them thoroughly, and beat them with mucilage into a proper mass for making lozenges.

Page 101, after Lin. Ammon. Comp. *insert*

TINCTURA AMMONIAE COMPOSITA, L.

PROCESS. Take of
Mastic, two drachms;
Rectified-spirit, nine fluidrachms;
Oil of lavender, fourteen minims;
Oil of amber, four minims;
Strong solution of ammónia, a pint.

Macerate the mastic in the spirit, to dissolve it, pour off the clear tincture, add the other ingredients, and agitate well.

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